ASTRO® 25
INTEGRATED VOICE AND DATA

GTR 8000 BASE RADIO

November 2011

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European Union (EU) Waste of Electrical and Electronic Equipment (WEEE) directive

The European Union's WEEE directive requires that products sold into EU countries must have the crossed out trashbin label on the product (or the package in some cases).

As defined by the WEEE directive, this cross-out trashbin label means that customers and end-users in EU countries should not dispose of electronic and electrical equipment or accessories in household waste.

Customers or end-users in EU countries should contact their local equipment supplier representative or service centre for information about the waste collection system in their country.

Document History

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GTR 8000 Base Radio

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GTR 8000 Base Radio

What Is Covered In This Manual?

This manual contains the following chapters:

- Chapter 1, "GTR 8000 Base Radio Description". This chapter provides a high-level description of the GTR 8000 Base Radio and the function it serves on your system.
- Chapter 2, "GTR 8000 Base Radio Theory of Operation". This chapter explains how the GTR 8000 Base Radio works in the context of your system.
- Chapter 3, "GTR 8000 Base Radio Installation". This chapter details installation procedures relating to the GTR 8000 Base Radio.
- Chapter 4, "GTR 8000 Base Radio Configuration". This chapter details configuration procedures relating to the GTR 8000 Base Radio.
- Chapter 5, "GTR 8000 Base Radio Optimization". This chapter contains optimization procedures and recommended settings relating to the GTR 8000 Base Radio.
- Chapter 6, "GTR 8000 Base Radio Maintenance". This chapter describes periodic maintenance procedures relating to the GTR 8000 Base Radio.
- Chapter 7, "GTR 8000 Base Radio Operation". This chapter details tasks that you will perform once the GTR 8000 Base Radio is installed and operational on your system.
- Chapter 8, "GTR 8000 Base Radio Troubleshooting". This chapter provides fault management and troubleshooting information relating to the GTR 8000 Base Radio.
- Chapter 9, "GTR 8000 Base Radio FRU Procedures". This chapter lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs) and includes replacement procedures applicable to the GTR 8000 Base Radio.
- Chapter 10, "GTR 8000 Base Radio Reference". This chapter contains supplemental reference information relating to the GTR 8000 Base Radio indicator LEDs.
- Chapter 11, "GTR 8000 Base Radio Disaster Recovery". This chapter provides references and information that will enable you to recover a GTR 8000 Base Radio in the event of failure.

Helpful Background Information

Motorola offers various courses designed to assist in learning about the system. For information, go to http://www.motorolasolutions.com/training to view the current course offerings and technology paths.

Related Information

In addition to the information in the table below, see the Related Information Guide.

Related Information	Purpose
Standards and Guidelines for Communication Sites (6881089E50)	Provides standards and guidelines that should be followed when setting up a Motorola communications site.
System Documentation Overview	For an overview of the ASTRO® 25 system documentation, open the graphical user interface for the ASTRO® 25 system documentation set and select the **System Documentation Overview** link. This opens a file that includes: • ASTRO® 25 system release documentation descriptions • ASTRO® 25 system diagrams • ASTRO® 25 system glossary For an additional overview of the system, review the architecture and descriptive information in the manuals that apply to your system configuration.
Dynamic System Resilience	Provides all the information required to understand, operate, maintain, and troubleshoot the Dynamic System Resilience feature.
Conventional Operations *Quick Guide for Replacing a Conventional QUANTAR® with a GTR 8000 Base Radio*	Provides the information required to understand and operate the conventional GTR 8000 Base Radio in a Centralized or Distributed Conventional Architecture.
Trunked IP Simulcast Subsystem Remote Site *HPD Standalone System - Infrastructure*	Proves the information required to understand and operate the GTR 8000 Base Radio in an ASTRO® 25 trunked site.

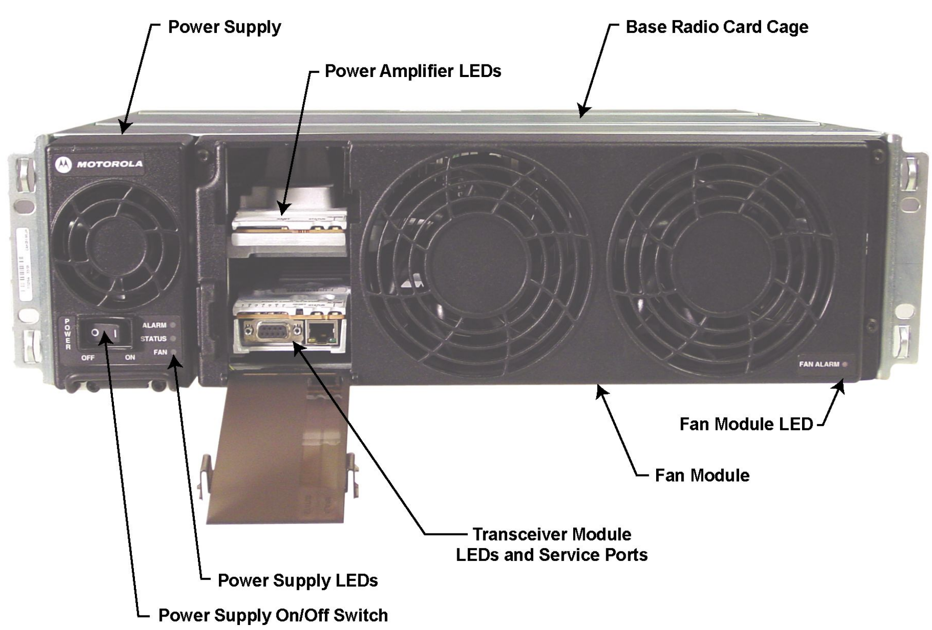
Chapter 1

GTR 8000 Base Radio Description

This chapter provides a high-level description of the GTR 8000 Base Radio and GPW 8000 Receiver and the function they serve in your system.

Introduction

Figure 1-1 GTR 8000 Base Radio/GPW 8000 Receiver



This manual provides information on the standalone GTR 8000 Base Radio and GPW 8000 Receiver and associated applications. The term “base radio” or “BR” is used to denote the transceiver and associated modules. As viewed in these instances, one “base radio” is a standalone configuration.

A GTR 8000 Base Radio consists of a transceiver module, power amplifier module, fan module and power supply. The transceiver module includes the functionality for the exciter, receiver, and station control with an optional transceiver option card. The base radio software, configuration, and network management, as well as inbound/outbound traffic handling, are performed through the transceiver module. On-board serial and Ethernet service ports are located on this module for local servicing through CSS. The power amplifier module amplifies the low-level modulated RF signal from the transceiver module and delivers the amplified signal on the path to the transmit antenna. The power supply module supports the transceiver and power amplifier modules. Radio Frequency Distribution System (RFDS) provides the interface between the transceivers and the site antennas and between the power amplifier and the site antennas.

GPW 8000 Receiver

A receive-only conventional GPW 8000 Receiver consists of a transceiver module, fan module and power supply. The transceiver module includes the functionality for the receiver and station control with or without an optional transceiver option card. The receiver software, configuration, and network management, as well as inbound traffic handling, are performed through the transceiver module. On-board serial and Ethernet service ports are located on this module for local servicing through CSS. The power supply module supports the transceiver module. Radio Frequency Distribution System (RFDS) provides the interface between the receiver and the site antennas.

The GPW 8000 Receiver provides all the receive function of a GTR 8000 Base Radio as a receive-only station in a Conventional Architecture or ASTRO 3.1 Conventional System. The GPW 8000 Receiver operates in a voting environment with connection to a comparator providing additional receive only stations in areas where it would otherwise be difficult to receive a signal from low power subscriber units. The GPW 8000 Receiver also operates as a monitor receiver in a non-voting environment with connection to a console.

GTR 8000 Base Radio/GPW 8000 Receiver Components

The following modules that make up the base radio/receiver and their functions are listed in Table 1-1.

Table 1-1 Base Radio/Receiver Modules

GTR 8000 Base Radio	Description
Power Supply	Operates from either an AC or DC input and provides the DC operating voltage for the base radio. Also provides a separate battery charger, which can be used to maintain the charge on a 48 VDC nominal system, positive or negative ground, if installed.

Table 1-1 Base Radio/Receiver Modules (Continued)

GTR 8000 Base Radio	Description
Power Amplifier (PA)*	Accepts a low-level modulated RF signal from the transceiver module and amplifies it for transmission through the site transmit antenna. Also provides a low-level RF feedback signal to the transceiver module to achieve the required transmitter linearity. Also performs functions related to the fan module.
Transceiver (XCVR)	Provides the control, exciter, and receiver functions for the base radio. NOTE: The exciter functionality is turned off in the GPW 8000 Receiver.
Transceiver Option Card	An optional board that attaches to the control board of the transceiver. Provides an internal 10 MHz frequency reference. For conventional base radio/receiver operation it also provides the analog interfaces and wild card I/Os. The transceiver option card is available in two categories: • OCXO (Oven Controlled Crystal Oscillator) • TCXO (Temperature Compensated Crystal Oscillator)
Fan	Provides intermittent forced air cooling for the power amplifier and transceiver modules.

* = Not applicable in the GPW 8000 Receiver.

Supported System Configurations

The GTR 8000 Base Radio is available in the following system architectures:

- High Performance Data (HPD)
- Trunked IP Simulcast Subsystems (IV&D)
- Trunked Single-Site Repeater Configuration (IV&D)
- Centralized Conventional Architectures
- Distributed Conventional (Subsystem) Architecture
- ASTRO 3.1 Conventional System

- Analog Only Conventional System

Supported Frequencies for Trunked IV&D and Conventional Architectures

The GTR 8000 Base Radio is available in the following frequency bands:

- 700, 800 MHz (700 MHz analog conventional is not available within the U.S.A. or Canada)
- UHF R1 (380-435 MHz)
- UHF R2 (435–524 MHz)
- VHF (136–174 MHz)

NOTE

RFDS information provided in this documentation pertains to the RFDS equipment supplied by Motorola.

Supported Frequencies for HPD

The GTR 8000 Base Radio is available for 25 kHz operation in 700 and 800 MHz frequency bands.

Overview For a GTR 8000 Base Radio in a Trunked IP Simulcast Subsystem

The base radio captures inbound signals through external receive (Rx) antennas from the subscriber/mobile radios and then amplifies, filters and demodulates the signals into voice packets which are forwarded to a comparator. The comparator processes the received voice packets for a particular call and forwards the best quality voice packets to the zone core, which routes them to the associated base radio at each remote site. At a predetermined time, all of the base radios transmit the voice packets simultaneously on the same frequency to complete the communication.

A maximum of 30 base radios can be installed per remote site. Each base radio has an Ethernet connection to a switch at the site for the Network Management interface.

Overview For a GTR 8000 Base Radio in a Trunked Single-Site Repeater Configuration

This configuration consists of standalone GTR 8000 Base Radios and standalone GCP 8000 Site Controllers in a single-site repeater configuration, or can be used in a multi-site system to provide a system migration step that enables replacement of PSC 9600 Site Controllers or base radios other than the GTR 8000 Base Radios. The base radios may be colocated with the site controllers, or be separated (non-colocated) from the site controllers.

NOTE

This configuration can only be used in non-voting configurations.

Support is provided only for FDMA when the base radios are physically separated from and not colocated with the site controllers. TDMA requires the use of a frequency reference and timing reference that can only be provided through the site controller’s CP3 links, which cannot be extended to non-colocated base radios when the distance exceeds the noted limits. This configuration is supported only on repeater sites.

An Ethernet cable is used to extend the site controller's signal to the first non-colocated base radio through the site controller's Net AUX port into the base radio's SC-A port. The site controller's Net AUX port must be enabled and configured using the CSS for 100/FULL (speed and duplex). When the distance between the site controllers and the first non-colocated base radio exceeds 328 ft. (100 m), an external HP2610 24-port Ethernet LAN switch must be used to extend the site controller's signal. When there are additional non-colocated base radios and those base radios are more than 328 ft. from the previous non-colocated base radio, additional Ethernet LAN switches are required to continue to extend the site controller’s signal.

If the distance between the first non-colocated base radio and subsequent non-colocated base radios is less than 328 ft. (100 m), a single Ethernet LAN switch can be used to distribute the site controller's call control signaling to those non-colocated base radios. The stated distance limit for a shielded twisted pair Ethernet cable (CAT5) is 328 ft. (100 m) before the signal degrades too much to be used.

When the Ethernet LAN switch is used in a configuration that does not include centralized network management, the switch must be programmed manually. See the *System LAN Switches* manual.

Procedure 1-1 How to Configure the HP2610 Ethernet LAN Switch

1	`ProCurve Switch 2610-24#`
2	`ProCurve Switch 2610-24#` **erase startup-config** (This removes any existing switch configuration)
3	`ProCurve Switch 2610-24#` **config** (This puts the switch into configuration mode)
4	`ProCurve Switch 2610-24(config)#` **int X** (Using Port X as an example)
5	`ProCurve Switch 2610-24(eth-X)#` **speed-duplex 100-Full** (This sets interface X to 100MB/Full Duplex)
6	`ProCurve Switch 2610-24(eth-X)#` **write memory** (This saves the configuration changes to persistent memory)

Once the site controller link is extended, the control plane could be open to access from elements other than the base radios. Each Ethernet LAN switch must be manually configured to provide MAC Port lockdown to make sure that only the proper devices can communicate with each other. MAC Port lockdown may also be applied on any unused Expansion Ports on the site controller. See the *MAC Port Lockdown* manual to lock down the site controller. The switch ports may be enabled or disabled according to specific security guidelines. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *System LAN Switches* manual.

Each non-colocated base radio is equipped with a transceiver option card, which provides an internal 10 MHz frequency reference. See the “Reference Oscillator Alignment Procedures” of the base radio Alignment Screens in the *Configuration/Service Software (CSS) Online Help* for alignment details. The base radios that are colocated with the site controllers do not require the transceiver option card.

Overview For a GTR 8000 Base Radio in a High Performance Data (HPD) Subsystem

The GTR 8000 Base Radio provides the radio frequency (RF) link between the system site controller and the subscriber/mobile radios. The base radio captures inbound signals through external receive (Rx) antennas from the subscriber/mobile radios and then amplifies, filters and demodulates the signals into data packets which are forwarded to the site controller. The site controller routes/receives digitized data payload to/from the Radio Network Gateway (RNG) for further processing and routing.

The site controller receives digitized data payload and control packets from the RNG and routes them to a specified base radio. The base radio extracts the control instructions from the packets and uses them for internal management such as channel frequency assignment. The base radio maps the digital data packets to discreet voltage levels which are then used to modulate an RF carrier. The modulated RF carrier is amplified and may be combined with other RF channels, filtered and routed to the transmission (Tx) antenna(s).

The first four base radios at the site are defined as home channel capable. Settings for the base radio are made through Unified Network Configurator (UNC) and Configuration/Service Software (CSS).

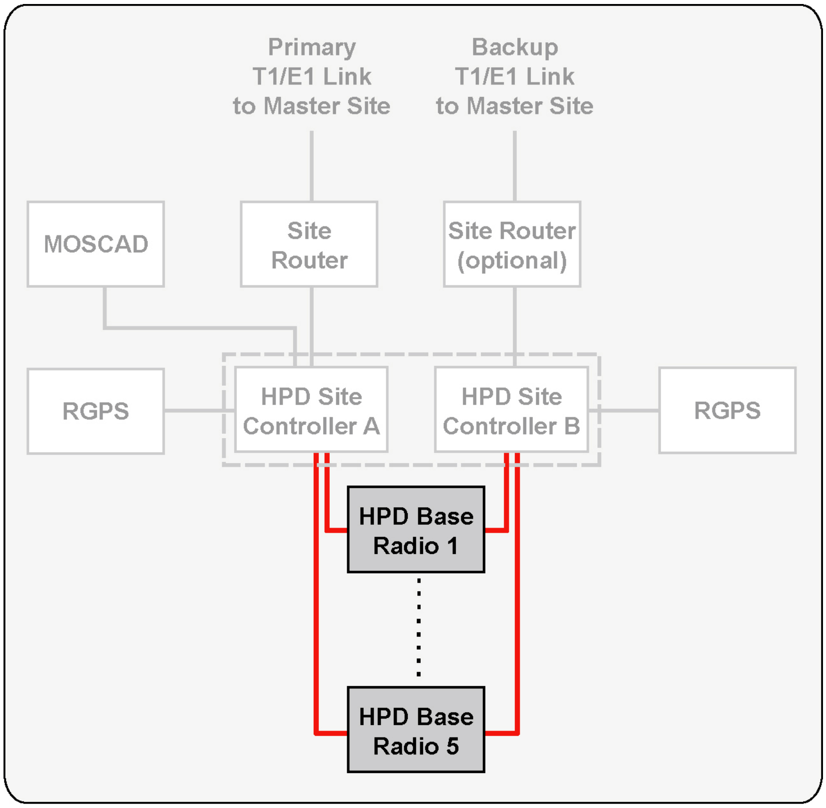
Besides the power supply module supporting the transceiver and power amplifier modules, it can also provide auxiliary power to a connected site controller or receive multicoupler/low noise amplifier (RMC/LNA).

The HPD base radio provides a full-duplex RF interface to HPD Mobile Subscriber Units (MSUs). The HPD base radios are available for 25 kHz HPD operation in the 700 or 800 MHz bands. Up to five HPD base radios may be installed at the site. Each base radio has an Ethernet connection to both of the site controller modules at the site.

The HPD base radio uses Radio Link Adaptation (RLA) to provide high-speed, reliable, enhanced data performance when communicating traffic with MSUs. RLA uses adaptive modulation techniques, with slower and more reliable modulation for control signaling and retries, and faster modulation methods when traffic is successfully being delivered between the base radio and MSUs.

The HPD base radio is implemented with 2X receiver diversity. This receiver diversity enhances the inbound signals from the MSUs on the channel.

Figure 1-2 GTR 8000 Base Radios in HPD Remote Site



HPD_RS_comp_base_radio

The HPD base radio uses Time Division Multiplex (TDM) frames for random access channels, reserved access channels, and broadcast messages. All carriers in the system are synchronized by a Global Positioning System (GPS) so that transmission slots are synchronized across sites. The base radio is able to schedule inbound/outbound traffic for half-duplex MSUs so that outbound traffic intended for the MSU does not conflict with inbound random or reserved access traffic from the MSU.

Overview for a GTR 8000 Base Radio or GPW 8000 Receiver in Conventional Architectures

Throughout this manual the term “conventional” addresses either an analog only base radio/receiver or an ASTRO® 25 Conventional base radio/receiver that operates in either digital mode or mixed (analog/digital) mode. Conventional base radios/receivers operate within:

- an analog only infrastructure

- a Centralized or Distributed Conventional Architecture, or
- an ASTRO 3.1 Conventional System.

Each conventional base radio/receiver uses either:

- a 2– or 4–wire TRC or 4–wire E&M interface in an analog infrastructure
- a V.24 interface for digital voice and data traffic to either a Channel Bank, Digital Interface Unit, CCGW, MLC 8000, or ASTRO-TAC 3000 Comparator and an optional 4-wire link for analog voice in a mixed mode configuration
- an IP interface for digital voice and data traffic to an CCGW or GCM 8000 Comparator.

NOTE

For information about conventional functions and topologies supported by the GTR 8000 base radio, see the *Conventional Operations* manual. Note that the base radio can be IP managed while using the 4–wire/V.24 interface for channel traffic.

NOTE

A GTR 8000 Base Radio or GPW 8000 Receiver can be implemented as a QUANTAR® replacement within an ASTRO 3.1 conventional system. The implementation details can be found in the *Quick Guide for Replacing a Conventional QUANTAR with a GTR 8000 Base Radio* manual.

ASTRO 25 Conventional Base Radio/Receiver

ASTRO® 25 Conventional base radio/receiver features include:

- Separate Tx and Rx network access code
- Console or repeat priority
- Repeater set-up knockdown from the console
- Voice and data
- Control Messages (TSBK)
- Standalone repeater
- Control station
- Receive-only station
- Voting
- Multicast
- Simulcast

- Console Control
  - Monitor Mode
  - Repeat Control
  - Frequency Select
  - Scan Control (supported for Gold Elite console)
  - Receive Qualifier Control (supported by Gold Elite console)
- WildCard Operation
- Multi-Channel – up to 16 channels with base station or repeater functionality
- Multiple Network Access Code (Multi-NAC) Operation
- Scan Operation
- Analog Phone Patch

An ASTRO® 25 Conventional base radio/receiver can be used in the following architectures:

- ASTRO 3.1 Conventional Systems
- Centralized Conventional Architectures
  - Zone Core with Colocated Conventional Channels
  - Trunked IP Simulcast Remote Site with Conventional Channels
  - Dispatch Console Site with Colocated Conventional Channels
  - Conventional-Only Remote Site
  - HPD Site with Conventional Channels
- Distributed Conventional (Subsystem) Architectures
  - Conventional Base Radio Sites
  - Conventional Hub Sites

Analog Conventional Base Radio/Receiver

Analog conventional base radio/receiver features include:

- 12.5 kHz analog channel operation with HearClear settings (800 MHz)
- Repeater Access Control
- Multi-Channel – up to 16 channel with base station or repeater functionality
- Alarm tones over-the-air and over-the-wireline
- Transmit Antenna Relay Control and Simplex Operation
- WildCard Operation
- E&M Interface; Ext PTT keying and COR receiver I/O
- 4-wire and V.24 connections to a DIU or an ASTRO-TAC 3000 Comparator using the same V.24 connector pin-outs as a QUANTAR® Base Radio

- Analog simulcast support using Gen Tx and PL Analog inputs and Ext PTT and Ext PTT keying
- Multi-PL receive operation
- RA/RT configuration with analog 4–wire connections
- Analog Wireline Automatic Level Control (ALC)
- Wideband Receiver Operation
- Telephone Interconnect
- PL/DPL
- Tone Remote Control (TRC)
- Fall Back In-Cabinet Repeat
- Control Station
- Interfaces for local microphone and speaker
- Receive-only Analog Functionality (GPW 8000 Receiver only)
- Simplex operation
- Scan Operation
- Voting
- Multicast
- Simulcast

An analog conventional base radio/receiver can be used in the following architectures:

- ASTRO 3.1 Conventional Systems
- Centralized Conventional Architectures
  - Zone Core with Colocated Conventional Channels
  - Trunked IP Simulcast Remote Site Conventional Channels
  - Dispatch Console Site with Colocated Conventional Channels
  - Conventional-Only Remote Site
- Distributed Conventional (Subsystem) Architectures
  - Conventional Base Radio Sites
  - Conventional Hub Sites

Power Efficiency Package

The base radio/receiver is available in a Power Efficiency Package, which provides low standby power consumption (less than or equal to 35 W) functionality for ASTRO® 25 Conventional base radios/receivers and trunked base radios operating in the UHF-R1 and UHF-R2 frequency bands. The Power Efficiency Package allows deployment of power to the base radios/receivers generated from alternate energy sources such as solar or wind.

The Power Efficiency Package hardware includes a modified transceiver, power amplifier, power supply, fan, and optional TCXO transceiver option card along with additional software configurations through CSS.

The following conditions must be met to obtain a power consumption of less than or equal to 35 W:

- DC source only
- Speaker turned OFF (if equipped with transceiver option card)
- No AUX loads
- CSS configured for applications not required for receiver diversity
- CSS Fan Holdover configured to "short" (45 seconds) (length of time the base radio fan stays ON after transmission)
- Ambient temperature of 104 degress F (40 degress C) or less (single fan operation – disabling one of the fans within the fan module. See "Removing/Replacing the Fan Module" in the FRU Procedures chapter for instructions on how to disable the fan.)

  NOTE

  Single fan operation requires the Tx Power Out in the CSS to be limited to 50 W.

- Transceiver, power amplifier, power supply, fan, and optional TCXO transceiver option card are all power efficiency package versions

NOTE

The TXCO transceiver option card is available only for non-simulcast conventional systems.

GTR 8000 Base Radio Specifications

The following lists the specifications for the GTR 8000 Base Radio.

- "GTR 8000 Base Radio/GPW 8000 Receiver Specifications for Integrated Voice & Data (700 and 800 MHz)" on page 1-12.
- "GTR 8000 Base Radio/GPW 8000 Receiver Specifications for Integrated Voice & Data UHF R1 (380–435 MHz)" on page 1-16
- "GTR 8000 Base Radio/GPW 8000 Receiver Specifications for Integrated Voice & Data UHF R2 (435–524 MHz) " on page 1-20.
- "GTR 8000 Base/GPW 8000 Receiver Radio Specifications for Integrated Voice & Data VHF (136–174 MHz) " on page 1-24.
- "GTR 8000 Base Radio Specifications for High Performance Data (700 and 800 MHz)" on page 1-28.

IMPORTANT

Specifications are subject to change without notice.

GTR 8000 Base Radio/GPW 8000 Receiver Specifications for Integrated Voice & Data (700 and 800 MHz)

Table 1-2 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications IV&D (700 and 800 MHz)

General Specifications	
Model Number	T7039A (GTR 8000 Base Radio) T7540A (GPW 8000 Receiver)
Number of Channels (trunked)	1
Number of Channels (conventional)	16
Size (H x W x D)	133mm x 483mm x 457mm (5.25" x 19" x 18")
Weight	21 kg (46 lbs) base radio 16 kg (36 lbs) receiver
Temperature Range	
Operating:	-30 to 60°C (-22 to 140°F)
Storage:	-40 to 85°C (-40 to 185°F)

Table 1-2 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications IV&D (700 and 800 MHz) (Continued)

General Specifications		
Operating Altitude		Up to 1800 meters (5900 feet) above mean sea level Above 1800 meters (5900 feet), the derating is 1.5°C/km (0.8°F/1000 feet) Above 3000 meters (9800 feet), the peak power derating for the Tx filter is 1 dB/1km (0.3 dB/1000 feet) Maximum operational altitude is 5000 meters (16900 feet)
Power Requirements		AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (GTR 8000 Base Radio Transmitting)		
	AC:	C4FM, FM: 470 W max H-DQPSK, LSM: 530 W max
	DC:	C4FM, FM: 430 W max H-DQPSK, LSM: 490 W max
Power Consumption (GPW 8000 Receiver)		
	AC:	85 W max
	DC:	50 W max
Power Consumption (GTR 8000 Base Radio Standby)		
	AC:	110 W max
	DC:	75 W max
Channel Spacing		12.5/25 kHz
Power Supply Type		Switching
Battery Revert		Included
Input/Output Impedance		50 Ohms
Antenna Connector Types		
	Tx:	N female
	Rx:	BNC female without preselector N female with preselector
Frequency Stability Internal Reference (transceiver option card)		Aging: 30 ppb/yr 100 ppb/5yr Temperature: 40 ppb
Frequency Stability External Reference		TRAK

Table 1-2 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications IV&D (700 and 800 MHz) (Continued)

General Specifications	
Frequency Generation	Synthesized

Table 1-3 GTR 8000 Base Radio Transmitter Specifications for IV&D (700 and 800 MHz)

Transmitter Specifications	
Frequency Range	762-776, 851-870 MHz
Power Output*	2-100 W
Electronic Bandwidth	Full Bandwidth
Modulation	C4FM, LSM, H-DQPSK, FM
Modulation Fidelity	5%
Spurious and Harmonic Emissions Attenuation	90 dB
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Analog Audio Distortion	Less than 2% at 1000 Hz
Emission Designators	8K70D1W, 8K10F1E, 8K70D7W, 8K10F7W, 8K10F1D, 16K0F3E, 9K80D7W, 11K0F3E
Adjacent Channel Power Ratio	
12.5 kHz offset, 6 kHz BW:	67 dB
Tx Noise in Rx Band	-145 dBc/Hz
Intermodulation Attenuation	80 dB

*Full transmitter output power is available during battery revert.

NOTE

The output power reference plane is the output connector of the power amplifier. The loss of the transmitter output cable (PA output to back of base radio) is 4% at 800 MHz. However, the base radio software allows the transmitter output power to be set at 10% above rated value.

Table 1-4 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D (700 and 800 MHz)

Receiver Specifications	
Frequency Range	792-825 MHz
Modulation (GTR 8000 Base Radio)	C4FM, H-CPM, FM
Modulation (GPW 8000 Receiver)	C4FM, FM

Table 1-4 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D (700 and 800 MHz) (Continued)

Receiver Specifications	
Analog Sensitivity (12 dB SINAD)	
12.5 kHz	-118 dBm
25 kHz	-117 dBm
Digital Sensitivity 5% Bit Error Rate Static (BER)	
C4FM:	-118 dBm
H-CPM:	-116 dBm
Faded Sensitivity 5% Bit Error Rate (BER)	
C4FM:	-110 dBm
Intermodulation Rejection	85 dB
Digital Adjacent Channel Rejection	60 dB
Analog Adjacent Channel Rejection (EIA603) Analog 12.5 kHz	75 dB
Analog Adjacent Channel Rejection (TIA603D)	
Analog 12.5 kHz	50 or 60 dB (adjustable)
Analog 25 kHz	80 dB
Spurious and Image Response Rejection	85 dB 100 dB with preselector
Analog Audio Response	+1, -3 dB from 6 dB per octave de-emphasis; 300–3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	3% or 5% (adjustable)
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Signal Displacement Bandwidth	1 kHz
Intermediate Frequencies	
1st:	73.35 MHz
2nd:	2.16 MHz
Electronic Bandwidth	Full Bandwidth
Blocking Immunity	100 dB
Conducted Spurious	-57 dBm
Bit Error Rate Floor	0.01%

Table 1-5 GTR 8000 Base Radio/GPW 8000 Receiver FCC Identification for IV&D (700 and 800 MHz)

FCC Identification			
Frequency Range	**Type**	**Power Output**	**Type Acceptance Number**
762-776 MHz	Transmitter	2-100 W	ABZ89FC5812
851-870 MHz	Transmitter	2-100 W	ABZ89FC5810
792-825 MHz	Receiver	N/A	ABZ89FR5811

Industry Canada

Table 1-6 shows the IC approval numbers, frequency range information, and power output range for the GTR 8000 Base Radio and GPW 8000 Receiver.

Table 1-6 GTR 8000 Base Radio/GPW 8000 Receiver Industry Canada for IV&D (700 and 800 MHz)

IC Approval Number	Frequency Range	Type	Power Output	IC Model Number
109AB-T7039	Tx 851–869 MHz, Rx 806–824 MHz	LSM	Variable 2–100 Watts (average)	T7039–800
109AB-T7039	Tx 851–869 MHz, Rx 806–824 MHz	C4FM, FM	Variable 2–100 Watts	T7039–800
109AB-T7039	Tx 764-770 MHz, Rx 794-800 MHz	LSM	Variable 2-100 Watts (average)	T7039-700
109AB-T7039	Tx 764-770 MHz, Rx 794-800 MHz	C4FM, FM	Variable 2-100 Watts	T7039-700
109AB-5811	Rx 794–800 MHz, Rx 806–824 MHz	N/A	N/A	T7540–800

GTR 8000 Base Radio/GPW 8000 Receiver Specifications for Integrated Voice & Data UHF R1 (380–435 MHz)

Table 1-7 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D UHF R1 (380–435 MHz)

General Specifications	
Model Number	T7039A (GTR 8000 Base Radio) T7504A (GPW 8000 Receiver)
Number of Channels (trunked)	1
Number of Channels (conventional)	16
Size (H x W x D)	133mm x 483mm x 457mm (5.25" x 19" x 18")
Weight	21 kg (46 lbs) base radio 16 kg (36 lbs) receiver

Table 1-7 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D UHF R1 (380–435 MHz) (Continued)

General Specifications		
Temperature Range		
	Operating:	-30 to 60°C (-22 to 140°F)
	Storage:	-40 to 85°C (-40 to 185°F)
Operating Altitude		Up to 1800 meters (5900 feet) above mean sea level Above 1800 meters (5900 feet), the derating is 1.5°C/km (0.8°F/1000 feet) Maximum operational altitude is 5000 meters (16900 feet)
Power Requirements		AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (GTR 8000 Base Radio Transmitting)		
	AC:	C4FM, FM: 500 W max H-DQPSK, LSM: 550 W max
	DC:	C4FM, FM: 460 W max H-DQPSK, LSM: 510 W max
Power Consumption (GPW 8000 Receiver)		
	AC:	85 W max
	DC:	50 W max
Power Consumption (GTR 8000 Base Radio Standby)		
	AC:	110 W max
	DC:	75 W max
Power Efficiency Standby (GTR 8000 Base Radio/GPW 8000 Receiver)		
	AC:	70 W
	DC:	35 W
Channel Spacing		12.5/25 kHz
Power Supply Type		Switching
Battery Revert		Included
Input/Output Impedance		50 Ohms
Antenna Connector Types		
	Tx:	N female
	Rx:	BNC female without preselector N female with preselector

Table 1-7 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D UHF R1 (380–435 MHz) (Continued)

General Specifications	
Frequency Stability Internal Reference (transceiver option card)	Aging: 30 ppb/yr 100 ppb/5yr Temperature: 40 ppb
Frequency Stability External Reference	TRAK
Frequency Generation	Synthesized

Table 1-8 GTR 8000 Base Radio Transmitter Specifications for IV&D UHF R1 (380–435 MHz)

Transmitter Specifications	
Frequency Range	380–435 MHz
Power Output*	2-110 W C4FM, FM 2–110 W LSM, H-DQPSK
Electronic Bandwidth	Full Bandwidth
Modulation	C4FM, LSM, H-DQPSK, FM
Modulation Fidelity	5%
Spurious and Harmonic Emissions Attenuation	90 dB
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Analog Audio Distortion	Less and 2% (1% typical) at 1000 Hz
Emissions Designators	8K70D1W, 8K10F1E, 8K10F7W, 8K10F1D, 8K70D7W, 16K0F3E, 9K80D7W, 11K0F3E
Adjacent Channel Power Ratio	
12.5 kHz offset, 6 kHz BW:	67 dB
Tx Noise in Rx Band	–142 dBc/Hz
Intermodulation Attenuation	65 dB

NOTE

The output power reference plane is the output connector of the power amplifier. The loss of the transmitter output cable (PA output to back of base radio) is 3% at 450 MHz. However, the base radio software allows the transmitter output power to be set at 10% above rated value.

Table 1-9 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D UHF R1 (380–435 MHz)

Receiver Specifications	
Frequency Range	380–435 MHz

Table 1-9 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D UHF R1 (380–435 MHz) (Continued)

Receiver Specifications	
Modulation (GTR 8000 Base Radio)	C4FM, H-CPM, FM
Modulation (GPW 8000 Receiver)	C4FM, FM
Analog Sensitivity (12 dB SINAD)	
12.5 kHz	-118 dBm
25 kHz	-117 dBm
Digital Sensitivity 5% Bit Error Rate Static (BER)	
C4FM:	-118 dBm
H-CPM:	-116 dBm
Faded Sensitivity 5% Bit Error Rate (BER)	
C4FM:	-110 dBm
Intermodulation Rejection	85 dB
Digital Adjacent Channel Rejection	60 dB
Analog Adjacent Channel Rejection (EIA603) Analog 12.5 kHz	75 dB
Analog Adjacent Channel Rejection (TIA603D)	
Analog 12.5 kHz	50 or 60 dB (adjustable)
Analog 25 kHz	80 dB
Spurious and Image Response Rejection	85 dB 100 dB with preselector
Analog Audio Response	+1, -3 dB from 6 dB per octave de-emphasis; 300–3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	3% or 5% (adjustable)
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Signal Displacement Bandwidth	1 kHz
Intermediate Frequencies	
1st:	73.35 MHz
2nd:	2.16 MHz
Electronic Bandwidth	Full Bandwidth
Blocking Immunity	100 dB
Conducted Spurious	-57 dBm

Table 1-9 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D UHF R1 (380–435 MHz) (Continued)

Receiver Specifications	
Bit Error Rate Floor	0.01%

Table 1-10 GTR 8000 Base Radio/GPW 8000 Receiver FCC Identification for IV&D UHF R1 (380–435 MHz)

FCC Identification			
Frequency Range	**Type**	**Power Output**	**Type Acceptance Number**
406.1–435 MHz	Transmitter	2-110 W C4FM, FM, LSM, H-DQPSK	ABZ89FC4821
380–435 MHz	Receiver	N/A	ABZ89FR4822

Industry Canada

Table 1-11 shows the IC approval numbers, frequency range information, and power output range for the GTR 8000 Base Radio.

Table 1-11 GTR 8000 Base Radio/GPW 8000 Receiver Industry Canada for IV&D (UHF-R1 380–435 MHz)

IC Approval Number	Frequency Range	Type	Power Output	IC Model Number
109AB-T7039	Tx 406.1–430 MHz, Rx 406.1–430 MHz	LSM, H-DQPSK, C4FM, FM	Variable 2–110 Watts	T7039-UHFR1
109AB-4822	Rx 406.1–430 MHz	N/A	N/A	T7540-UHFR1

GTR 8000 Base Radio/GPW 8000 Receiver Specifications for Integrated Voice & Data UHF R2 (435–524 MHz)

Table 1-12 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D UHF R2 (435–524 MHz)

General Specifications	
Model Number	T7039A (GTR 8000 Base Radio) T7540A (GPW 8000 Receiver)
Number of Channels (trunked)	1
Number of Channels (conventional)	16
Size (H x W x D)	133mm x 483mm x 457mm (5.25" x 19" x 18")

Table 1-12 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D UHF R2 (435–524 MHz) (Continued)

General Specifications		
Weight		21 kg (46 lbs) base radio 16 kg (36 lbs) receiver
Temperature Range		
	Operating:	-30 to 60°C (-22 to 140°F)
	Storage:	-40 to 85°C (-40 to 185°F)
Operating Altitude		Up to 1800 meters (5900 feet) above mean sea level Above 1800 meters (5900 feet), the derating is 1.5°C/km (0.8°F/1000 feet) Maximum operational altitude is 5000 meters (16900 feet)
Power Requirements		AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (GTR 8000 Base Radio Transmitting)		
	AC:	C4FM, FM: 460 W max H-DQPSK, LSM: 510 W max
	DC:	C4FM, FM: 420 W max H-DQPSK, LSM: 470 W max
Power Consumption (GPW 8000 Receiver)		
	AC:	85 W max
	DC:	50 W max
Power Consumption (GTR 8000 Base Radio Standby)		
	AC:	110 W max
	DC:	75 W max
Power Efficiency Standby (GTR 8000 Base Radio/GPW 8000 Receiver)		
	AC:	70 W
	DC:	35 W
Channel Spacing		12.5/25 kHz
Power Supply Type		Switching
Battery Revert		Included
Input/Output Impedance		50 Ohms
Antenna Connector Types		
	Tx:	N female
	Rx:	BNC female without preselector N female with preselector

Table 1-12 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D UHF R2 (435–524 MHz) (Continued)

General Specifications	
Frequency Stability Internal Reference (transceiver option card)	Aging: 30 ppb/yr 100 ppb/5yr Temperature: 40 ppb
Frequency Stability External Reference	TRAK
Frequency Generation	Synthesized

Table 1-13 GTR 8000 Base Radio Transmitter Specifications for IV&D UHF R2 (435–524 MHz)

Transmitter Specifications	
Frequency Range	435–524 MHz
Power Output*	2-110 W C4FM, FM 2-100 W LSM, H-DQPSK
Electronic Bandwidth	Full Bandwidth
Modulation	C4FM, LSM, H-DQPSK, FM
Modulation Fidelity	5%
Spurious and Harmonic Emissions Attenuation	90 dB
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Analog Audio Distortion	Less than 2% (1% typical) at 1000 Hz
Emissions Designators	8K70D1W, 8K10F1E, 8K10F7W, 8K10F1D, 8K70D7W, 16K0F3E, 9K80D7W, 11K0F3E
Adjacent Channel Power Ratio	
12.5 kHz offset, 6 kHz BW:	67 dB
Tx Noise in Rx Band	-142 dBc/Hz
Intermodulation Attenuation	65 dB

*Full transmitter output power is available during battery revert.

NOTE

The output power reference plane is the output connector of the power amplifier. The loss of the transmitter output cable (PA output to back of base radio) 3% at 450 MHz. However, the base radio software allows the transmitter output power to be set at 10% above rated value.

Table 1-14 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D UHF R2 (435–524 MHz)

Receiver Specifications	
Frequency Range	435–524 MHz
Modulation (GTR 8000 Base Radio)	C4FM, H-CPM, FM
Modulation (GPW 8000 Receiver)	C4FM, FM
Analog Sensitivity (12 dB SINAD)	
12.5 kHz	-118 dBm
25 kHz	-117 dBm
Digital Sensitivity 5% Bit Error Rate Static (BER)	
C4FM:	-118 dBm
H-CPM:	-116 dBm
Faded Sensitivity 5% Bit Error Rate (BER)	
C4FM:	-110 dBm
Intermodulation Rejection	85 dB
Digital Adjacent Channel Rejection	60 dB
Analog Adjacent Channel Rejection (EIA603) Analog 12.5 kHz	75 dB
Analog Adjacent Channel Rejection (TIA603D)	
Analog 12.5 kHz	50 or 60 dB (adjustable)
Analog 25 kHz	80 dB
Analog Audio Response	+1, -3 dB from 6 dB per octave de-emphasis; 300–3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	3% or 5% (adjustable)
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Spurious and Image Response Rejection	85 dB 100 dB with preselector
Signal Displacement Bandwidth	1 kHz
Intermediate Frequencies	
1st:	73.35 MHz
2nd:	2.16 MHz
Electronic Bandwidth	Full Bandwidth
Blocking Immunity	100 dB

Table 1-14 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D UHF R2 (435–524 MHz) (Continued)

Receiver Specifications	
Conducted Spurious	-57 dBm
Bit Error Rate Floor	0.01%

Table 1-15 GTR 8000 Base Radio/GPW 8000 Receiver FCC Identification for IV&D UHF R2 (435–524 MHz)

FCC Identification			
Frequency Range	Type	Power Output	Type Acceptance Number
435–512 MHz	Transmitter	2-110 W C4FM, FM, 2-100 W, LSM, H-DQPSK	ABZ89FC4819
435–524 MHz	Receiver	N/A	ABZ89FR4820

Industry Canada

Table 1-16 shows the IC approval numbers, frequency range information, and power output range for the GTR 8000 Base Radio.

Table 1-16 GTR 8000 Base Radio/GPW 8000 Receiver Industry Canada for IV&D (UHF-R2 435–524 MHz)

IC Approval Number	Frequency Range	Type	Power Output	IC Model Number
109AB-T7039	Tx 450–470 MHz, Rx 450–470 MHz	LSM, H-DQPSK, C4FM, FM	Variable 2–110 Watts	T7039-UHFR2
109AB-4820	Rx 450–470 MHz	N/A	N/A	T7540-UHFR2

GTR 8000 Base/GPW 8000 Receiver Radio Specifications for Integrated Voice & Data VHF (136–174 MHz)

Table 1-17 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D VHF (136–174 MHz)

General Specifications	
Model Number	T7039A (GTR 8000 Base Radio) T7540A (GPW 8000 Receiver)
Number of Channels (trunked)	1
Number of Channels (conventional)	16

Table 1-17 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D VHF (136–174 MHz) (Continued)

General Specifications		
Size (H x W x D)		133mm x 483mm x 457mm (5.25" x 19" x 18")
Weight		21 kg (46 lbs) base radio 16 kg (36 lbs) receiver
Temperature Range		
	Operating:	-30 to 60°C (-22 to 140°F)
	Storage:	-40 to 85°C (-40 to 185°F)
Operating Altitude		Up to 1800 meters (5900 feet) above mean sea level Above 1800 meters (5900 feet), the derating is 1.5°C/km (0.8°F/1000 feet) Maximum operational altitude is 5000 meters (16900 feet)
Power Requirements		AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption (GTR 8000 Base Radio Transmitting)		
	AC:	C4FM, FM: 500 W max H-DQPSK, LSM: 410 W max
	DC:	C4FM, FM: 460 W max H-DQPSK, LSM: 360 W max
Power Consumption (GPW 8000 Receiver)		
	AC:	85 W max
	DC:	50 W max
Power Consumption (GTR 8000 Base Radio Standby)		
	AC:	110 W max
	DC:	75 W max
Channel Spacing		12.5/25 kHz
Power Supply Type		Switching
Battery Revert		Included
Input/Output Impedance		50 Ohms
Antenna Connector Types		
	Tx:	N female
	Rx:	BNC female without preselector N female with preselector

Table 1-17 GTR 8000 Base Radio/GPW 8000 Receiver General Specifications for IV&D VHF (136–174 MHz) (Continued)

General Specifications	
Frequency Stability Internal Reference (transceiver option card)	Aging: 30 ppb/yr 100 ppb/5yr Temperature: 40 ppb
Frequency Stability External Reference	TRAK
Frequency Generation	Synthesized

Table 1-18 GTR 8000 Base Radio Transmitter Specifications for IV&D VHF (136–174 MHz)

Transmitter Specifications	
Frequency Range	136–174 MHz
Power Output*	2-100 W C4FM, FM 2–60 W LSM, H-DQPSK
Electronic Bandwidth	Full Bandwidth
Modulation	C4FM, LSM, H-DQPSK, FM
Modulation Fidelity	5%
Spurious and Harmonic Emissions Attenuation	90 dB
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Analog Audio Distortion	Less than 2% (1% typical) at 1000 Hz
Emissions Designators	8K70D1W, 8K10F1E, 8K10F7W, 8K10F1D, 8K70D7W, 16K0F3E, 9K80D7W, 11K0F3E
Adjacent Channel Power Ratio	
12.5 kHz offset, 6 kHz BW:	67 dB
Intermodulation Attenuation	55 dB

*Full transmitter output power is available during battery revert.

NOTE

The output power reference plane is the output connector of the power amplifier. The loss of the transmitter output cable (PA output to back of base radio) 1% at 150 MHz. However, the base radio software allows the transmitter output power to be set at 10% above rated value.

Table 1-19 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D VHF (136–174 MHz)

Receiver Specifications	
Frequency Range	136–174 MHz

Table 1-19 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D VHF (136–174 MHz) (Continued)

Receiver Specifications	
Modulation (GTR 8000 Base Radio)	C4FM, H-CPM, FM
Modulation (GPW 8000 Receiver)	C4FM, FM
Analog Sensitivity (12 dB SINAD)	
12.5 kHz	-119 dBm
25/30 kHz	-118 dBm
Digital Sensitivity 5% Bit Error Rate Static (BER)	
C4FM:	-119 dBm
H-CPM:	-117 dBm
Faded Sensitivity 5% Bit Error Rate (BER)	
C4FM:	-111 dBm
Intermodulation Rejection	85 dB
Digital Adjacent Channel Rejection	60 dB
Analog Adjacent Channel Rejection (EIA603) Analog 12.5 kHz	75 dB
Analog Adjacent Channel Rejection (TIA603D)	
Analog 12.5 kHz	50 or 60 dB (adjustable
Analog 25 kHz	80 dB
Spurious and Image Response Rejection	90 dB 95 dB with preselector
Analog Audio Response	+1, -3 dB from 6 dB per octave de-emphasis; 300–3000 Hz referenced to 1000 Hz at line output
Analog Audio Distortion	3% or 5% (adjustable)
Analog FM Hum and Noise	
12.5 kHz	45 dB
25 kHz	50 dB
Signal Displacement Bandwidth	1 kHz
Intermediate Frequencies	
1st:	44.85 MHz
2nd:	2.16 MHz
RF Input Connector with Optional Preselector	N female
Electronic Bandwidth	Full Bandwidth
Blocking Immunity	100 dB

Table 1-19 GTR 8000 Base Radio/GPW 8000 Receiver Specifications for IV&D VHF (136–174 MHz) (Continued)

Receiver Specifications	
Conducted Spurious	-57 dBm
Bit Error Rate Floor	0.01%

Table 1-20 GTR 8000 Base Radio/GPW 8000 Receiver FCC Identification for IV&D VHF (136–174 MHz)

FCC Identification			
Frequency Range	**Type**	**Power Output**	**Type Acceptance Number**
136–174 MHz	Transmitter	2-100 W C4FM, FM 2–60 W LSM, H-DQPSK	ABZ89FC3790
136–174 MHz	Receiver	N/A	ABZ89FR3791

Industry Canada

Table 1-21 shows the IC approval numbers, frequency range information, and power output range for the GTR 8000 Base Radio.

Table 1-21 GTR 8000 Base/GPW 8000 Receiver Radio Industry Canada for IV&D (VHF 136–174 MHz)

IC Approval Number	Frequency Range	Type	Power Output	IC Model Number
109AB-T7039	Tx 138–174 MHz, Rx 138–174 MHz	C4FM, FM	Variable 2–100 Watts	T7039-VHF
109AB-T7039	Tx 138–174 MHz, Rx 138–174 MHz	LSM, H-DQPSK	Variable 2–60 Watts	T7039-VHF
109AB-3791	Rx 138–174 MHz	N/A	N/A	T7540-VHF

GTR 8000 Base Radio Specifications for High Performance Data (700 and 800 MHz)

Table 1-22 General Specifications for GTR 8000 Base Radio for HPD (700 and 800 MHz)

General Specifications	
Model Number	T7039A
Number of Channels	1
Size (H x W x D)	133mm x 483mm x 457mm (5.25" x 19" x 18")
Weight	21 kg (46 lbs)

Table 1-22 General Specifications for GTR 8000 Base Radio for HPD (700 and 800 MHz) (Continued)

General Specifications	
Temperature Range	
Operating:	-30 to 60°C (-22 to 140°F)
Storage:	-40 to 85°C (-40 to 185°F)
Operating Altitude	Up to 1800 meters (6000 feet) above mean sea level
Power Requirements	AC: 90-264 VAC, 47-63 Hz DC: 43.2-60 VDC
Power Consumption	AC: 450 W DC: 410 W
Channel Spacing	25 kHz
Modulation	64 QAM, 16 QAM, QPSK
Power Supply Type	Switching
Battery Revert	Included
Input/Output Impedance	50 Ohms
Antenna Connector Types	
Tx:	N female
Rx:	BNC female
Frequency Stability	External Reference (TRAK)
Frequency Generation	Synthesized

Table 1-23 Transmitter Specifications for GTR 8000 Base Radio for HPD (700 and 800 MHz)

Transmitter Specifications	
Frequency Range	762-776, 851-870 MHz
Power Output*	2-50 W
Electronic Bandwidth	Full Bandwidth
Error Vector Magnitude	10%
Spurious and Harmonic Emissions Attenuation	90 dB
Emissions Designators	17K7D7D
Adjacent Channel Power Ratio	
25 kHz offset, 18 kHz BW:	58 dB
37.5 kHz offset, 25 kHz BW:	65 dB
Tx Noise in Rx Band	-142 dBc/Hz

Table 1-23 Transmitter Specifications for GTR 8000 Base Radio for HPD (700 and 800 MHz) (Continued)

Transmitter Specifications	
Intermodulation Attenuation	80 dB

* Full transmitter output power is available during battery revert.

NOTE

The output power reference plane is the output connector of the power amplifier. The loss of the transmitter output cable (PA output to back of base radio) is 4% at 800 MHz. However, the base radio software allows the transmitter output power to be set at 10% above rated value.

Table 1-24 Receiver Specifications for GTR 8000 Base Radio (700 and 800 MHz HPD)

Receiver Specifications	
Frequency Range	792-825 MHz
Digital Sensitivity 1% Bit Error Rate Static (BER)	
64 QAM:	-98 dBm
16 QAM:	-104 dBm
QPSK:	-111dBm
Faded Sensitivity 1% Bit Error Rate TU50 (BER)	
64 QAM:	-90 dBm
16 QAM:	-96 dBm
QPSK:	-101 dBm
Faded Sensitivity 5% Bit Error Rate HT200 (BER)	
64 QAM:	-90 dBm
Faded Sensitivity 2% Bit Error Rate HT200 (BER)	
16 QAM:	-94 dBm
Faded Sensitivity 1% Bit Error Rate HT200 (BER)	
QPSK:	-98 dBm
Intermodulation Rejection*	75 dB
Digital Adjacent Channel Rejection*	50 dB
Spurious and Image Response Rejection*	85 dB
Intermediate Frequencies	
1st:	73.35 MHz
2nd:	2.16 MHz

Table 1-24 Receiver Specifications for GTR 8000 Base Radio (700 and 800 MHz HPD) (Continued)

Receiver Specifications	
Electronic Bandwidth	Full Bandwidth
Blocking Immunity	90 dB
Conducted Spurious	-57 dBm
Bit Error Rate Floor	0.01%
Co-Channel Rejection QPSK	11 dB

* Reference signal is QPSK

Table 1-25 FCC Identification for GTR 8000 Base Radio for HPD (700 and 800 MHz)

FCC Identification			
Frequency Range	Type	Power Output	Type Acceptance Number
762-776 MHz	Transmitter	2-50 W	ABZ89FC5812
851-870 MHz	Transmitter	2-50 W	ABZ89FC5810
792-825 MHz	Receiver	N/A	ABZ89FR5811

Industry Canada

Table 1-26 shows the IC approval numbers, frequency range information, and power output range for the GTR 8000 Base Radio.

Table 1-26 Industry Canada for GTR 8000 Base Radio (700/800 MHz)

IC Approval Number	Frequency Range	Type	Power Output	IC Model Number
109AB-T7039	Tx 851–866 MHz, Rx 806–821 MHz	HPD	Variable 2–50 Watts (average)	T7039–800
109AB-T7039	Tx 764-770 MHz, Rx 794-800 MHz	HPD	Variable 2-50 Watts (average)	T7039-700

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Chapter

2

GTR 8000 Base Radio Theory of Operation

For an understanding of the GTR 8000 Base Radio components, review the modules that provide the base radio functionality, the modules that provide RF distribution functionality (RFDS), and the backplane that connects to other modules within the site.

This chapter explains how the GTR 8000 Base Radio works in the context of your system.

Functions of the GTR 8000 Base Radio Modules

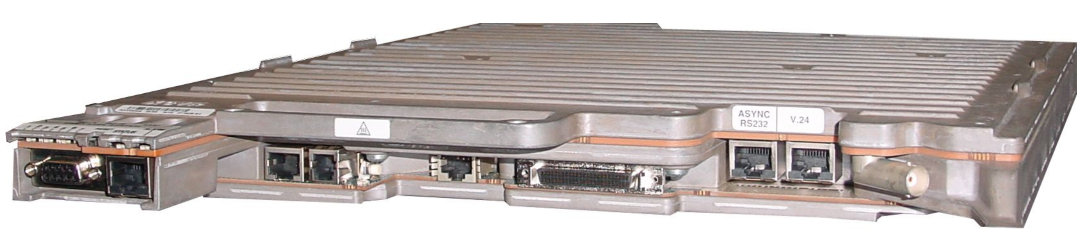
The following lists GTR 8000 Base Radio modules:

- Transceiver (XCVR) module (with or without transceiver option card)
- Power amplifier module (not applicable in a GPW 8000 Receiver)
- Fan module
- Power supply module

Function of the Transceiver Module

The transceiver module provides the control, exciter, receiver, and optional transceiver option card for the base radio/receiver. The transceiver is shown in Figure 2-1.

Figure 2-1 Transceiver Module (Front View)



GTR8000_XCVR_wSAC

The transceiver generates the station reference, which typically needs to be locked on to one of many possible external sources. The external source can be either the site controller TDM clocks or the external reference operating at 5 or 10 MHz. An internal frequency reference operating at 10 MHz is available in an optional transceiver option card.

The transceiver SPI bus allows communication with its receiver and exciter circuitry, as well as the power supply and power amplifier modules.

There are two or three circuit boards in the transceiver:

- **Transceiver Control Board**: Performs the control management, digital signal processing, and transmit and receive data formatting for the base radio.
- **Transceiver RF Board**: Contains DC power conversion/regulation and performs receiver and exciter functions.
- **Transceiver Option Card**: An optional board that attaches to the control board. Provides an internal 10 MHz frequency reference. For conventional base radio/receiver operation it also provides the analog interfaces and wildcard I/Os. The transceiver option card requires an internal frequency reference oscillator alignment at different intervals that is mandated by it's category and frequency band. See Base Radio Service Help > Service Screens > Alignment Screens in the CSS Online Help for the alignment procedures and mandated intervals. The transceiver option card is available in two categories:
  - **OCXO (Oven Controlled Crystal Oscillator)** – operates at 0.1 ppm which is inclusive to temperature and aging. The OCXO Transceiver Option Card is available in 700/800 MHz, UHF R1/R2, and VHF frequency bands.
  - **TCXO (Temperature Compensated Crystal Oscillator)** – operates at 1.5 ppm, of which 0.5 ppm is allocated to temperature and 1.0 ppm is allocated to aging. Reference precision with the TCXO is traded for lower power consumption. The TCXO mandates more frequency maintenance intervals. The TCXO transceiver option card is available in UHF R1/R2 frequency bands. The TXCO is only available for non-simulcast conventional systems.

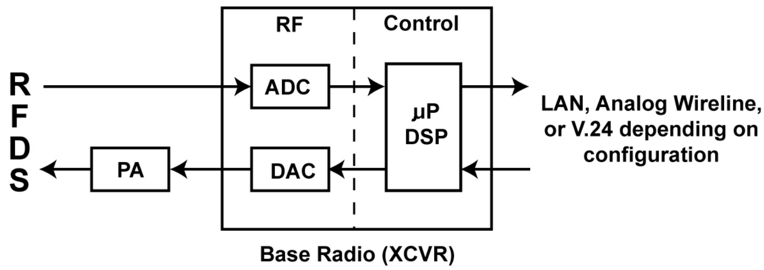
Transceiver Control Board

The main operating software for the base radio is loaded in the XCVR's control section. As the main manager for the base radio, the XCVR control board provides operational control over the other station modules. It handles three types of information flow, in the following ways:

- Serves as a gateway between the network and RF functionality, by distributing the RF payload to and from the network.
- Supports operational and diagnostic functions with digital control data (for example: site information, channel assignments, and identification numbers for call processing).
- Ensures the flow of other network management configuration information.

Figure 2-2 shows the information flow through the transceiver control and RF sections for trunked and digital conventional operation.

Figure 2-2 GTR 8000 Base Radio Information Flow



Transceiver RF Board

In addition to DC power conversion/regulation, the XCVR RF board provides circuitry for the following exciter and receiver functions.

Exciter

The exciter on the XCVR RF board provides the transmitter functions for the base radio. The exciter circuitry generates a low-level, modulated RF signal that passes to the power amplifier. It supports various modulation types as well as bandwidths up to 25 kHz, through software programming.

The exciter also provides a controlled output power level to the power amplifier.

NOTE

The Exciter is present in a GPW 8000 Receiver but, is powered down to save energy.

Receiver

The receiver provides either single receiver input or dual (HPD or TDMA) receiver inputs for dual diversity. The receiver also provides enhanced diagnostic capabilities using an on board noise source generator. It includes a wide tuning range (electronic varactor-tuned) preselector. The preselector is electronically tuned to the desired receive frequency anywhere between 792-825 MHz, UHF R1 380–435 MHz, UHF R2 435-524 MHz, or VHF 136–174 MHz.

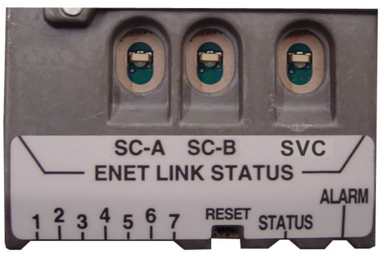
Transceiver External Interfaces

The transceiver external interfaces include seven external ports, a switch and LEDs. If a transceiver option card is part of the transceiver, there are four additional external ports. See “Connections – Front” in the Installation chapter for the port connections. For information on the LEDs, see the Reference chapter.

Transceiver Switch

There is one multifunction Reset switch on the front of the transceiver module, accessible through the drop-down door to the left of the fans. Figure 2-3 shows the location of the Reset switch. The Reset switch has two functions:

Figure 2-3 Transceiver Reset Switch (viewable through drop-down door)



GTR8000_XCVR_LED_Closeup_1

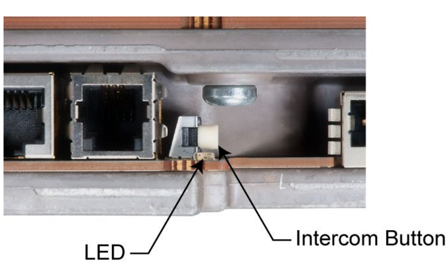
Table 2-1 Transceiver Front Reset Switch Functions

User Action	Result
Press switch for less than 1 second	Service Mode (LED 3 lights amber)
Press switch for greater than 3 seconds	Transceiver Control Module Reset

Transceiver Option Card Intercom Button

There is one intercom button on the front of the transceiver option card, accessible behind the fan module. Figure 2-4 shows the location of the button. Pressing the intercom button toggles the intercom function between the ON and OFF states.

Figure 2-4 Transceiver Option Card Intercom Button (behind fan module)



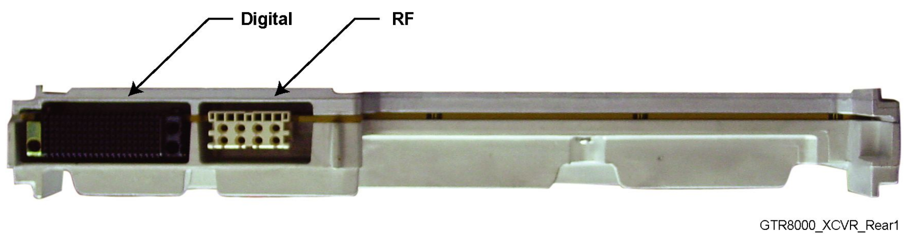
XCVR_Option_Card_Intercom_LED

Transceiver Ports (Rear)

The transceiver interconnects to the backplane using a 120–pin HVDML digital connector and 8–pack RF connector, as shown in Figure 2-5. These connections handle multiple signals including power supply communications, power amplifier communications, fan interface and peripheral interface. The digital connection receives alarm data, which are used to pass reference and control data to the base radio.

- **Single Receiver Input:**An RJ–45 Ethernet port on the base radio backplane is cabled to a site LAN switch for this channel. The backplane also provides an RF connection to the transceiver for receive (Rx) path A.
- **Dual Receiver Input:** RJ–45 Ethernet ports on the base radio backplane are cabled to corresponding ports on the site controller backplanes (HPD). The backplane also provides RF connections to the transceiver for receive (Rx) paths A and B (HPD and TDMA).

Figure 2-5 Transceiver Module (Backplane Connections)



Function of the Power Amplifier Module

NOTE

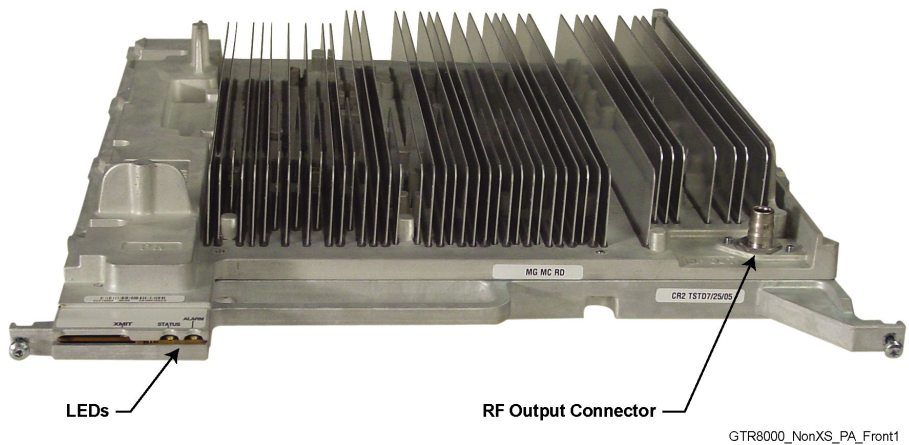
The PA module is not applicable in a GPW 8000 Receiver.

The power amplifier (PA) is a forced convection-cooled RF power amplifier. It accepts a low-level modulated RF signal from the transceiver module, and amplifies it for transmission through the site transmit antenna. Also, to complete the Cartesian correction loop (linearization method), it provides a low level RF feedback signal to the transceiver module to achieve the required transmitter linearity.

Transmit power output can be set using Configuration/Service Software (CSS). See the procedure “How to Configure Tx Power Values and Battery Type for GTR 8000 Base Radio Configurations” in the Configuration section of the documentation.

The power amplifier also performs functions related to the fan module, including reporting of the fan module status and supplying power to the fan power bus.

Figure 2-6 Power Amplifier Module



The power amplifier is comprised of six internal modules:

- Core Board
- Converter Board
- Driver Amplifier Board
- Final Amplifier Board
- Distribution Board
- Output Circuitry

Power Amplifier Input/Output Connections

There are three electrical connection assemblies on the power amplifier:

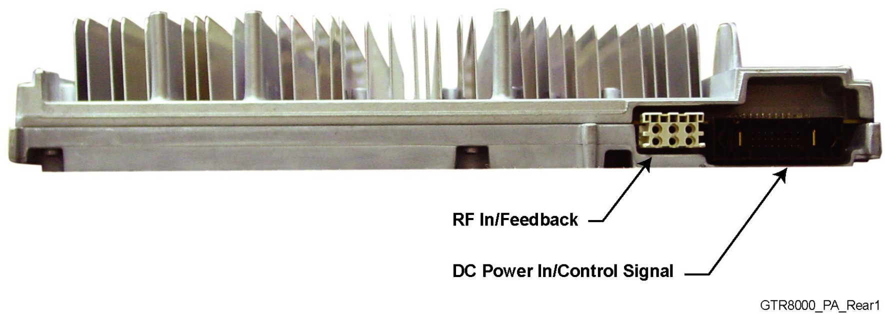
- RF output (front QN "quick-N" connector) on front of power amplifier module

NOTE

This connection is cabled to the N-type female bulkhead connection at the rear of the base radio housing.

- DC power supply/control signal (backplane connection)
- RF input/feedback (backplane connection)

Figure 2-7 Power Amplifier (Backplane Connections)



Function of the Fan Module

The fan module provides intermittent forced air cooling for the power amplifier and transceiver modules. The fans are controlled by a thermostat in the modules behind the fan module. The fan module houses two 119 mm axial fans which deliver a total of approximately 160 cubic feet per minute of airflow. Nominal fan speed is 4100 revolutions per minute. Each fan has a built in speed sensor which turns on the red Fan Alarm LED if the fan speed for either fan falls below 30% of the rated speed.

If the fan module is used for the Power Efficiency Package, the following must be configured in the CSS in order to take full advantage of the Power Efficiency Package:

- Optional fan holdover time (length of time the base radio/receiver fan stays ON after transmission).
- Disabling one of the fans within the fan module. See “Removing/Replacing the Fan Module” in the FRU Procedures chapter for instructions on how to disable one of the fans.
- Configuring the base radio's Tx Power Out in the CSS should be limited to 50 W.

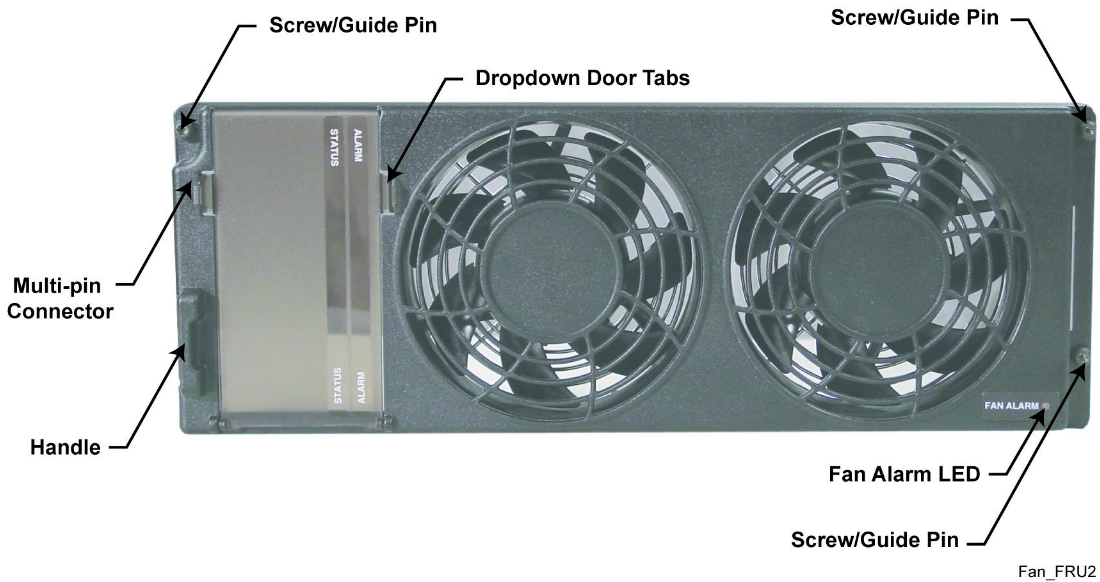
The fan module connects to the base radio backplane through a 4–pin port on the front of the base radio chassis.

NOTE

The power supply module has its own fan which provides independent airflow.

Figure 2-8 shows a fan module.

Figure 2-8 Fan Module



Function of the Power Supply

The power supply is shown in Figure 2-9.

Figure 2-9 Power Supply

The power supply, with front-to-rear airflow, operates from either an AC or DC input and provides the DC operating voltage for the base radio. However the power supply prioritizes an AC source (if present) over that of a DC source.

NOTE

If the power supply module is used for the Power Efficiency Package, the power supply must be used in DC mode in order to obtain the 35 W standby power consumption performance.

When operating from an AC source (90 to 264 VAC, 47-63 Hz), the supply generates two DC output voltages of 29 V with respect to output ground. The power supply automatically adjusts to AC input ranges and supplies a steady output.

In AC mode, the power supply provides a separate battery charger which can be used to maintain the charge on a 48 VDC nominal system, positive or negative ground, if installed. The supply generates two DC output voltages of 29 V with reference to output ground, when operating from a DC source (43.2 VDC to 60VDC maximum, positive or negative ground. This voltage limit includes consideration of the battery charging "float voltage" associated with the intended supply system, regardless of the marked power rating of the equipment.

The battery charger is not usable when operating from a DC input power source.

The power supply contains several switching-type power supply circuits as follows:

- Power factor correction circuitry
- Battery charging circuitry
- Diagnostics and monitoring circuitry

The power supply controls its own continuously running fan, changing its speed to fast or slow as needed.

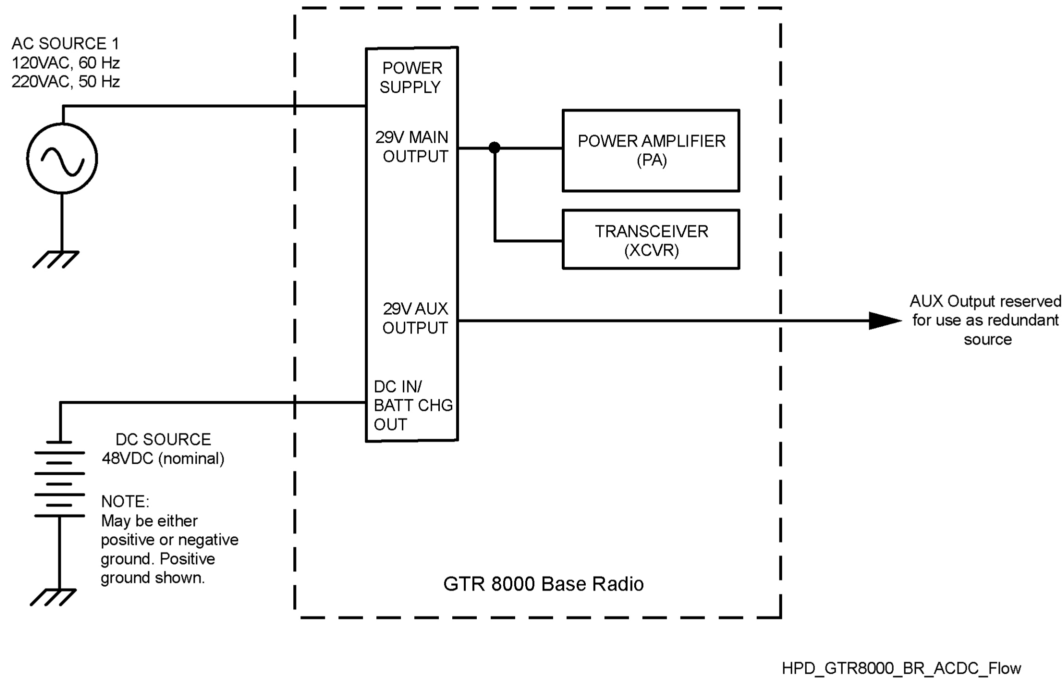
NOTE

If the power supply module is used for the Power Efficiency Package, the power supply fan does not run below a 40° C air inlet temperature.

AC/DC Power Distribution — Base Radio

Figure 2-10 shows the AC and DC power distribution in the GTR 8000 Base Radio.

Figure 2-10 AC and DC Power Distribution in the GTR 8000 Base Radio



If present, the GTR 8000 Base Radio operates from AC power as the preferred power source. When AC power is not available, the base radio switches to operate from the DC source. Operation returns to the AC source when the AC source is restored. Switchover from AC to DC and back again is fully automatic. No operator action is required.

The Main DC output of the power supply is used to provide power to the power amplifier and the transceiver. The Auxiliary output of the power supply is not used within the base radio, but is reserved for use as a redundant power input to other site components such as a standalone site controller (if installed at the site).

Power Supply Battery Charger

The power supply includes an integrated battery charger. The battery charger is controlled entirely through software resident on the associated transceiver module. Software contains the information on supported battery types and obtains user specific information pertaining to the particular site. The transceiver software receives battery bus voltage and battery temperature information from the power supply and uses these variables in conjunction with supported battery charging profiles to return a signal which sets the charger output voltage appropriately. The battery charge and temperature conditions may be viewed through Configuration/Service Software (CSS) or through alarms sent to Unified Event Manager.

The maximum charging current available from the base radio integrated charger is 3A (48VDC nominal system). Motorola recommends that a battery with capacity no larger than 60A-hr be connected to a single charger in order to ensure that the charger is capable of maintaining an adequate state-of-charge on the backup battery, and that the backup battery is restored to full capacity within a reasonable amount of time following operation on battery backup power.

In addition to standard sealed lead-acid batteries (valve-regulated lead acid or gel cells), the base radio supports charging of vented lead-acid and NiCd batteries.

Battery Temperature Sensor Cable

The integrated charger in the power supply performs temperature compensated battery charging when the temperature sensor is connected. If the sensor is disconnected, the charger continues to operate as an uncompensated charger with the charging profile following the minimum charger voltage specified by the battery manufacturer.

The base radio includes a battery temperature sensor provided as a 40–foot cable which attaches to a battery pack, supplied by your organization, and to the backplane of the base radio. This three-wire cable carries a voltage signal to the power supply from the sensor element which needs to be mounted in close proximity to the storage battery. Voltage is proportional to the battery temperature and is used by diagnostic circuitry in the power supply module. This cable can be extended to a total length of 190 feet using 50–foot extensions. For instructions, see “Mounting the Battery Temperature Sensor” in the Installation section of the documentation.

IMPORTANT

Continuous operation with a disconnected sensor is not recommended.

ON/OFF Switch for Power Supply and Battery Charger

Table 2-2 identifies the switch states for the power supply and battery charger.

Table 2-2 GTR 8000 Base Radio ON/OFF Switch - States for Power Supply and Battery Charger

Switch Position	Power Supply State	Battery Charger State
ON (1)	• Power Factor Correction (PFC) section is active (AC input only) • Main DC converter runs to create the MAIN and AUX DC outputs	Can be started if desired (AC input only)
OFF (0)	• Main DC converter is turned OFF and the MAIN and AUX DC outputs become 0.0VDC	Disabled (AC input only)

Power Supply Module - Backplane Connections

Table 2-3 identifies the connections for the power supply module backplane.

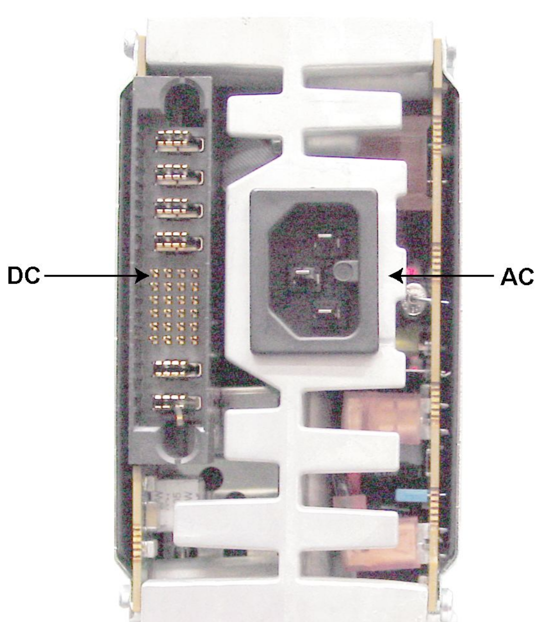
Table 2-3 GTR 8000 Base Radio Power Supply Module Backplane Connections

Port/Type	Description
AC	Input only

Table 2-3 GTR 8000 Base Radio Power Supply Module Backplane Connections (Continued)

Port/Type	Description
Battery / DC Power and Control Signal	**48 VDC:** • Provides the DC input to the power supply when operating from a DC source. • Connects the charger output to the standby battery when operating from an AC input with a standby DC battery. **NOTE** 29 VDC is an internal connection and not accessible. **29 VDC:** • Provides the Main and Aux DC outputs of the power supply for use by the power amplifier, and transceiver. Other signals handled by this connector include control interface and battery temperature interface.

Figure 2-11 Power Supply Connections (Rear)



GTR8000_PS_Rear1

Backplanes and Card Cages

Card cages for the GTR 8000 Base Radio are created with a welded and riveted design. Each card cage has a backplane.

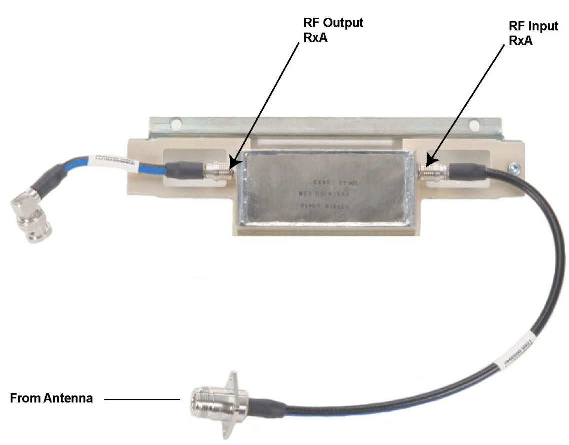
- See “Connections for Trunked Simulcast and Conventional” and “Connections for High Performance Data (HPD)” in the Installation chapter.

RFDS Modules

The Radio Frequency Distribution System (RFDS) equipment included in your system depends on what options were purchased from Motorola. The following lists some examples of the RFDS equipment available for your system.

RFDS - Preselector (700/800 MHz)

Figure 2-12 Preselector Filter (700/800 MHz)

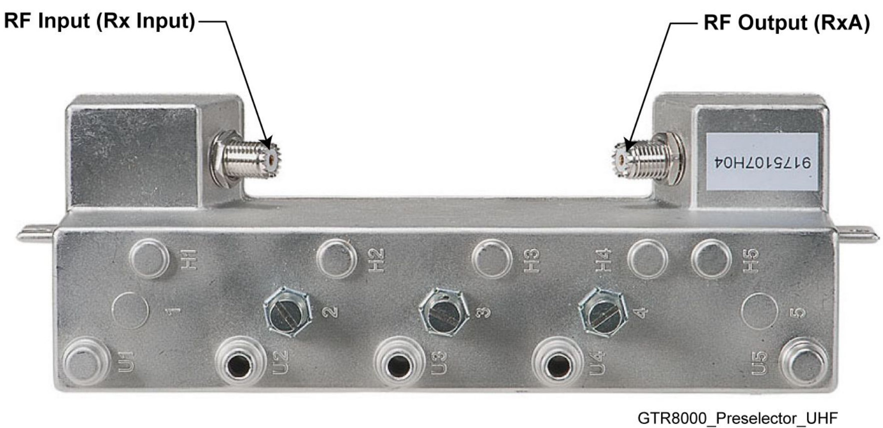


The preselector provides a first level of band pass filtering for inbound RF signals. RF input and output connectors are cabled to the GTR 8000 Base Radio's RF Output RxA. This filter must be included to fulfill TIA102-CAAB Class A spurious response rejection (90 dB). The filter is usually not required when using a receiver multicoupler system. This filter can NOT be retuned in the field.

RFDS - Preselector (UHF)

The preselector rejects unwanted signals including the transmitter signals from overloading the receiver. This filter must be included to fulfill TIA102-CAAB Class A spurious response rejection (90 dB). The filter is usually not required when using a receiver multicoupler system. This filter can be retuned in the field.

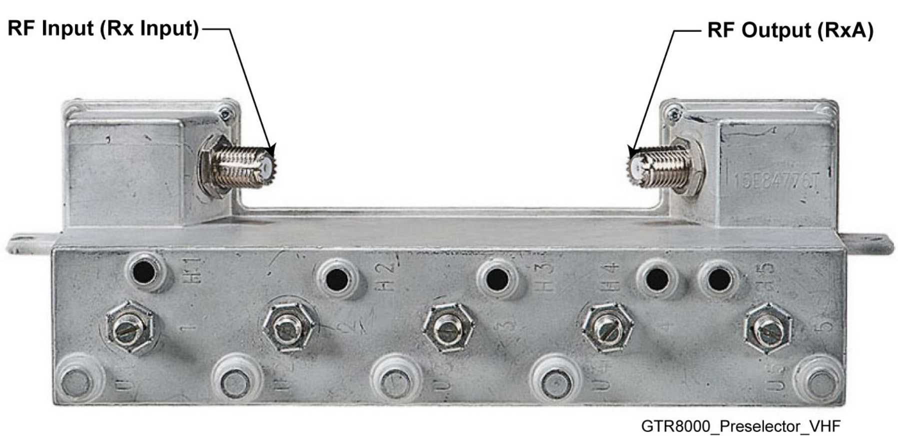
Figure 2-13 Preselector (UHF)



RFDS - Preselector (VHF)

The preselector rejects unwanted signals including the transmitter signals from overloading the receiver. This filter must be included to fulfill TIA102-CAAB Class A spurious response rejection (90 dB). The filter is usually not required when using a receiver multicoupler system. This filter can be retuned in the field.

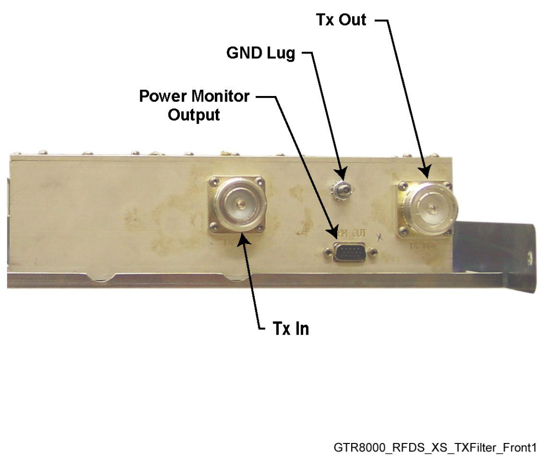
Figure 2-14 Preselector (VHF)



RFDS - Transmit Filter (700/800 MHz)

The transmit filter removes any noise in the receive sub-band. The Tx Output from the GTR 8000 Base Radio connects to the Transmit Filter's Tx In. The Transmit Filter's Tx Out connects the Tx Output or any other RFDS equipment.

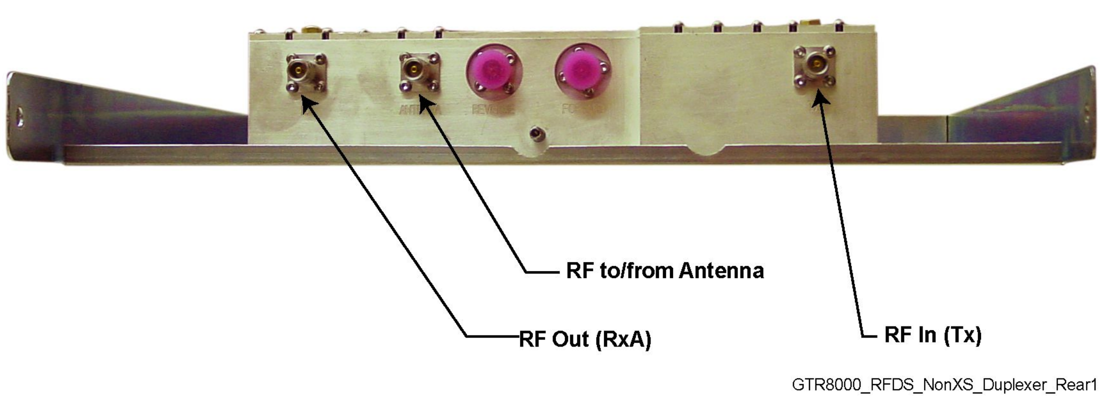
Figure 2-15 Transmit Filter (700/800 MHz)



RFDS - Duplexer (700/800 MHz)

This optional filter provides the capability to use a single antenna for both transmitter and receiver. Only one transmitter and receiver can be combined.

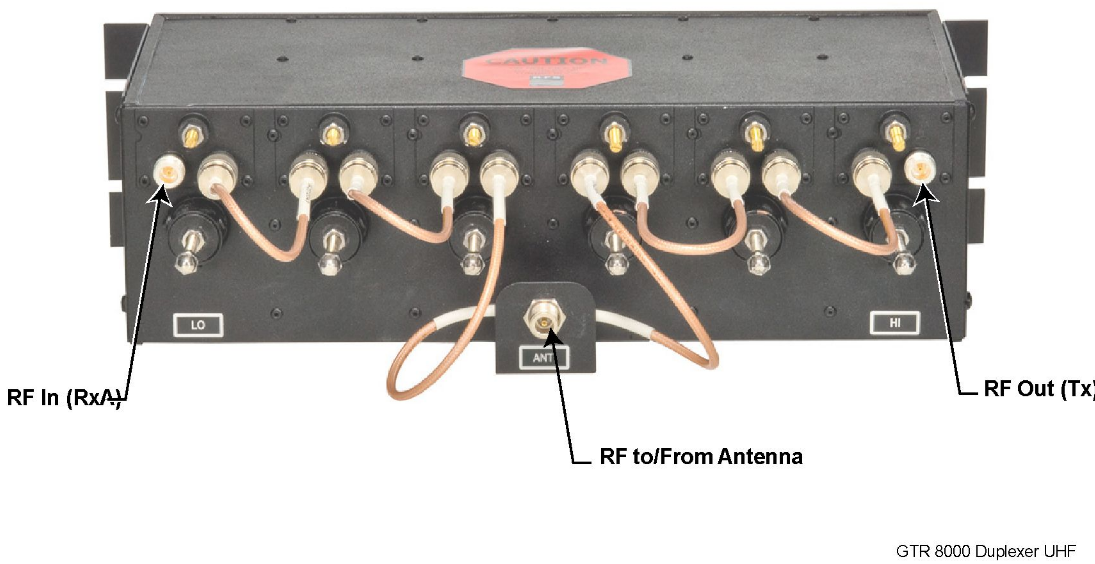
Figure 2-16 Duplexer (700/800 MHz)



RFDS - Duplexer (UHF)

This optional filter provides the capability to use a single antenna for both transmitter and receiver. Only one transmitter and receiver can be combined.

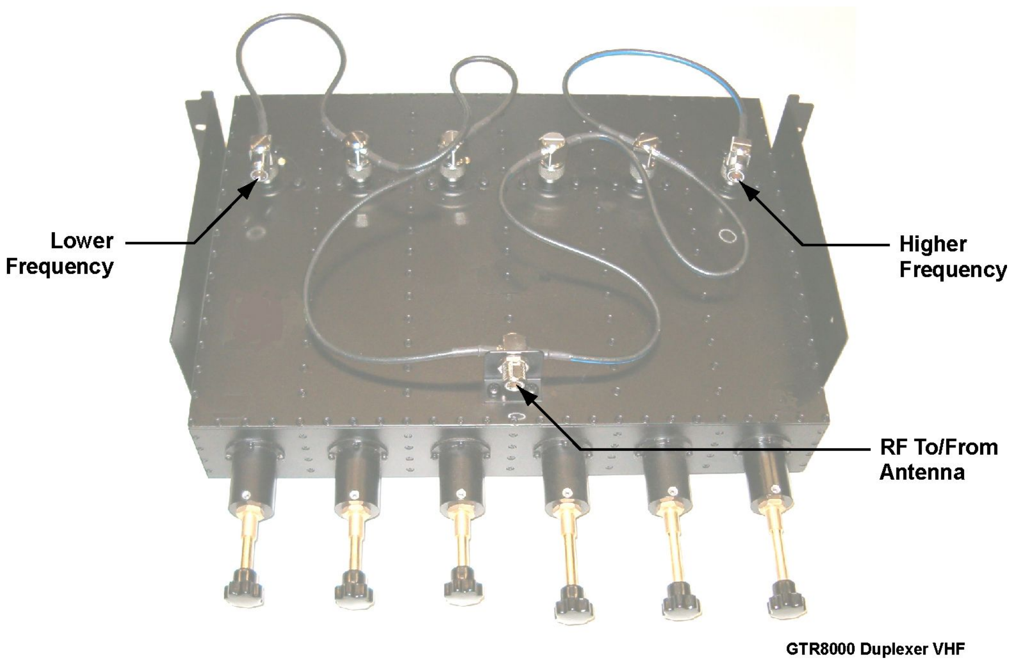
Figure 2-17 Duplexer (UHF)



RFDS - Duplexer (VHF)

This optional filter provides the capability to use a single antenna for both transmit and receiver. Only one transmitter and receiver can be combined.

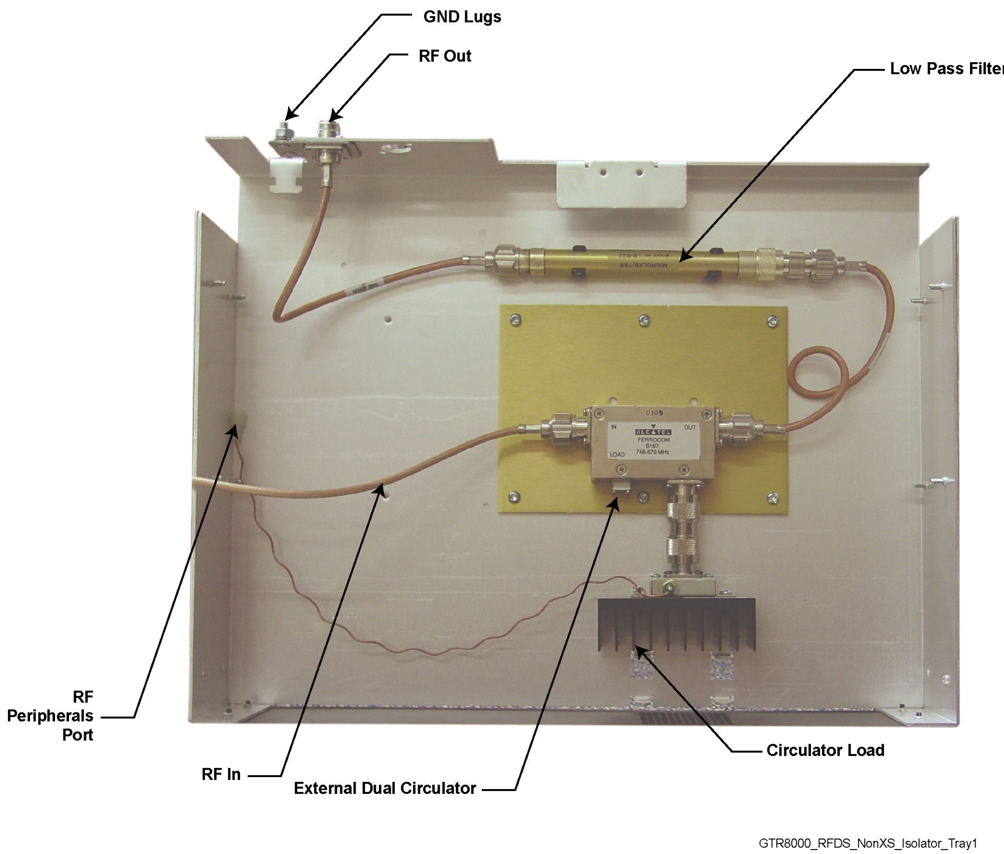
Figure 2-18 Duplexer (VHF)



RFDS - External Dual Circulator/Isolator Tray (700/800 MHz)

An option for the GTR 8000 Base Radio is an External Dual Circulator module which isolates the base radio from the antenna, thus preventing the transmitter from generating intermodulation. The circulator load dissipates reflected power. It includes a cable that connects to the RF Peripherals port on the base radio backplane to provide temperature monitoring.

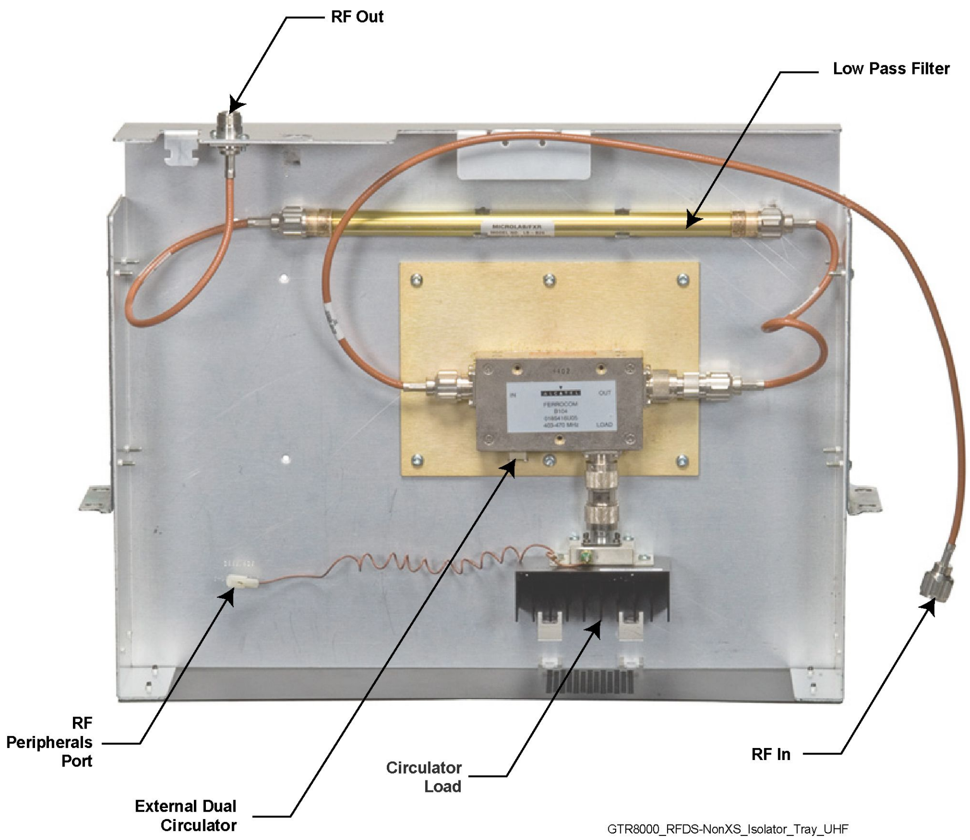
Figure 2-19 External Dual Circulator/Isolator Tray (700/800 MHz)



RFDS - External Dual Circulator/Isolator Tray (UHF)

An option for the GTR 8000 Base Radio is an External Dual Circulator module which isolates the base radio from the antenna, thus preventing the transmitter from generating intermodulation. The circulator load dissipates reflected power. It includes a cable that connects to the RF Peripherals port on the base radio backplane to provide temperature monitoring.

Figure 2-20 External Dual Circulator/Isolator Tray (UHF)



RFDS - External Dual Circulator/Isolator Tray (VHF)

An option for the GTR 8000 Base Radio is an External Dual Circulator module which isolates the base radio from the antenna, thus preventing the transmitter from generating intermodulation. The circulator load dissipates reflected power. It includes a cable that connects to the RF Peripherals port on the base radio backplane to provide temperature monitoring.

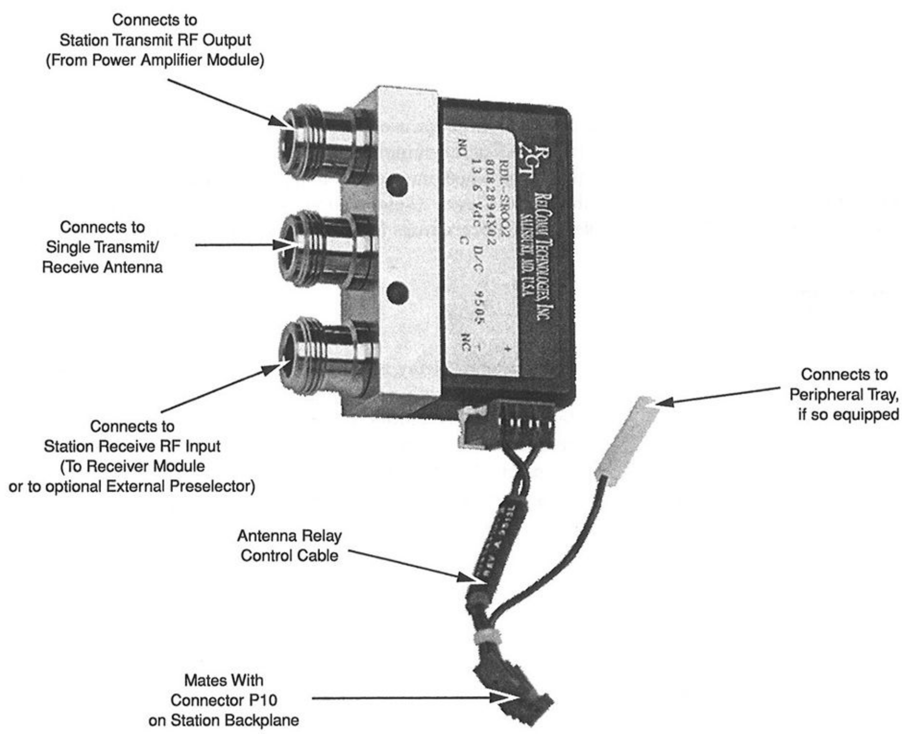
Antenna Relay Module

The antenna relay module allows a single antenna to be used for both transmit and receive functions on a conventional GTR 8000 Base Radio. The antenna relay module is controlled by a signal from the base radio transceiver module and is typically mounted on the backplane cover on the rear of the base radio, or on the peripheral tray if the base radio is equipped with other options. Figure 2-21 shows the antenna relay module input and output external connections. Settings for the antenna relay module are made through Configuration/Service Software (CSS) and UNC.

NOTE

If the antenna relay is Enabled and it is then disconnected, a failure is generated and logged stating the antenna relay is disconnected. However, the base radio also generates an exciter failure because the antenna relay is controlled and monitored through the exciter module. The exciter failure should be ignored until after the antenna relay failure is corrected. The failures are reported in the Status Report and UEM.

Figure 2-21 Antenna Relay Module Connections



Mounting Locations

The antenna relay module may be installed in either of two locations.

On base radios **not equipped** with the peripheral tray, the antenna relay is mounted on the backplane cover. Figure 2-22 shows the backplane mounting location and Figure 2-23 shows the antenna relay mounted on the backplane cover.

Figure 2-22 Base Radio Backplane Mounting Location

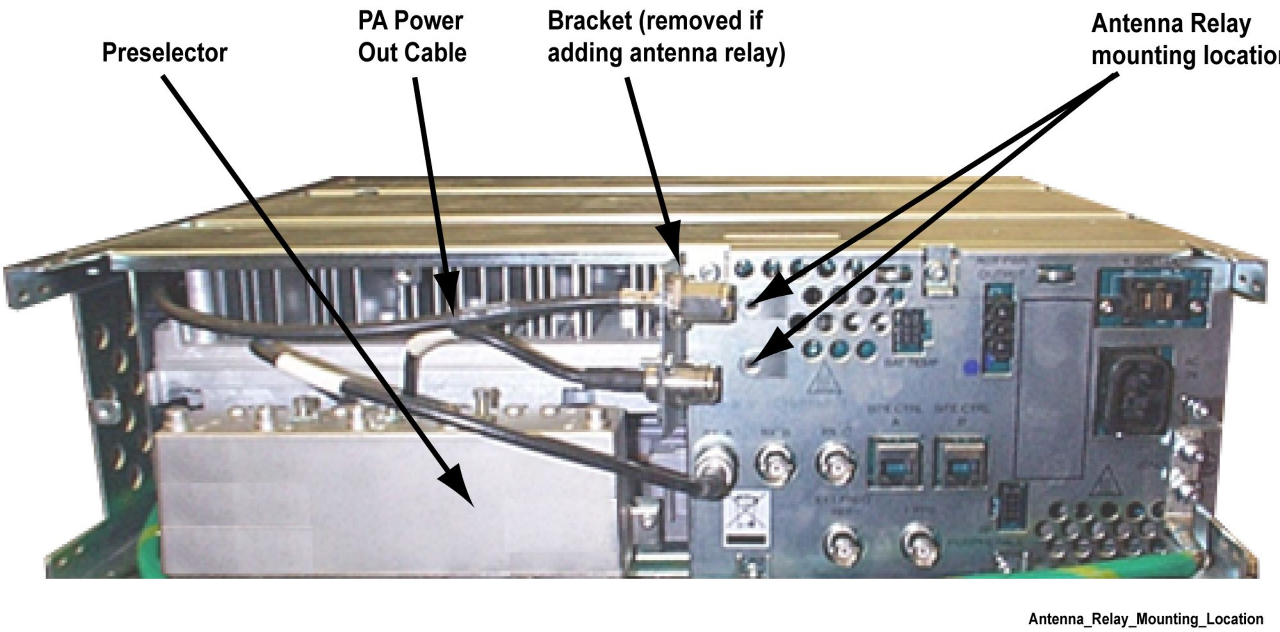
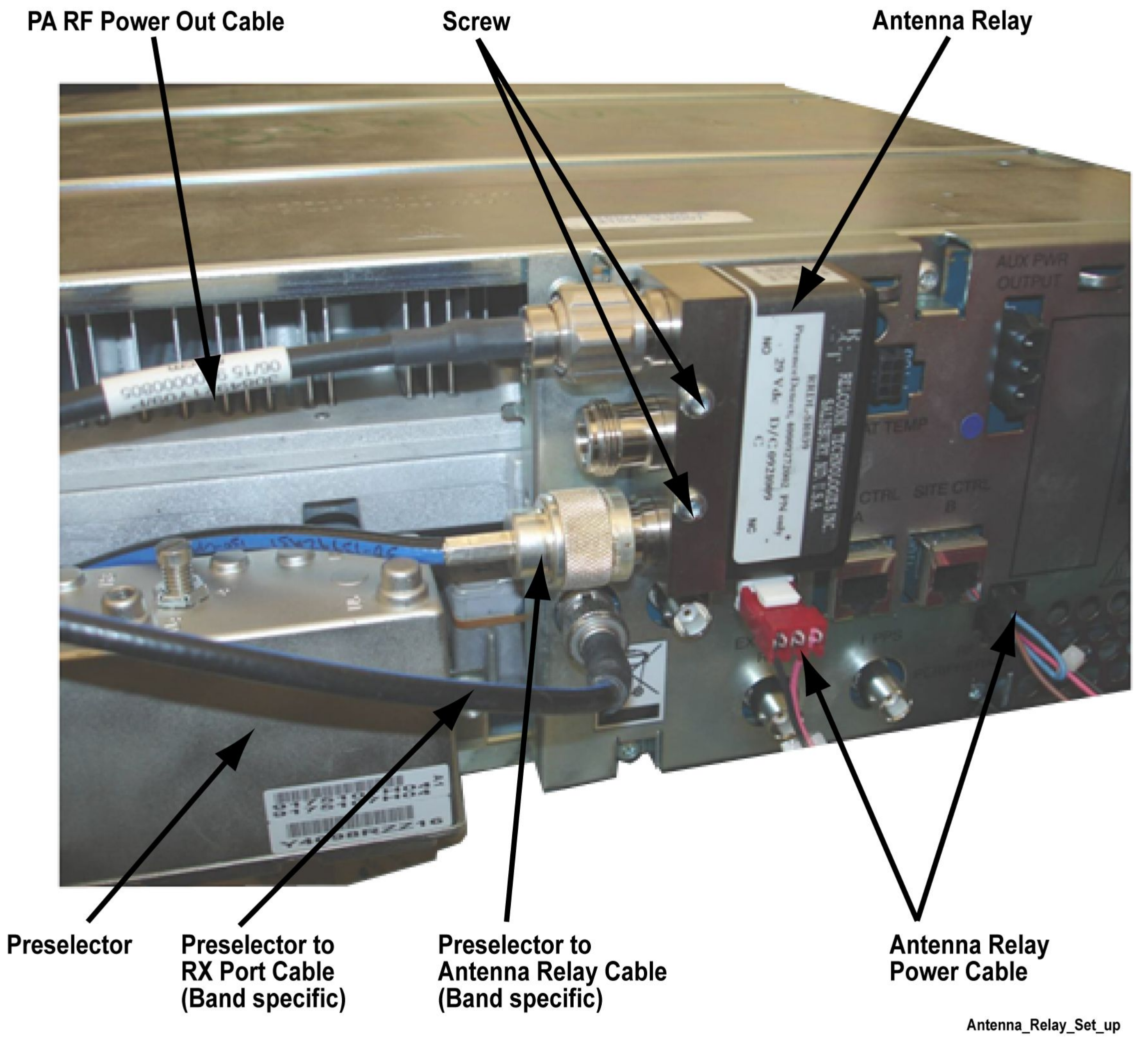
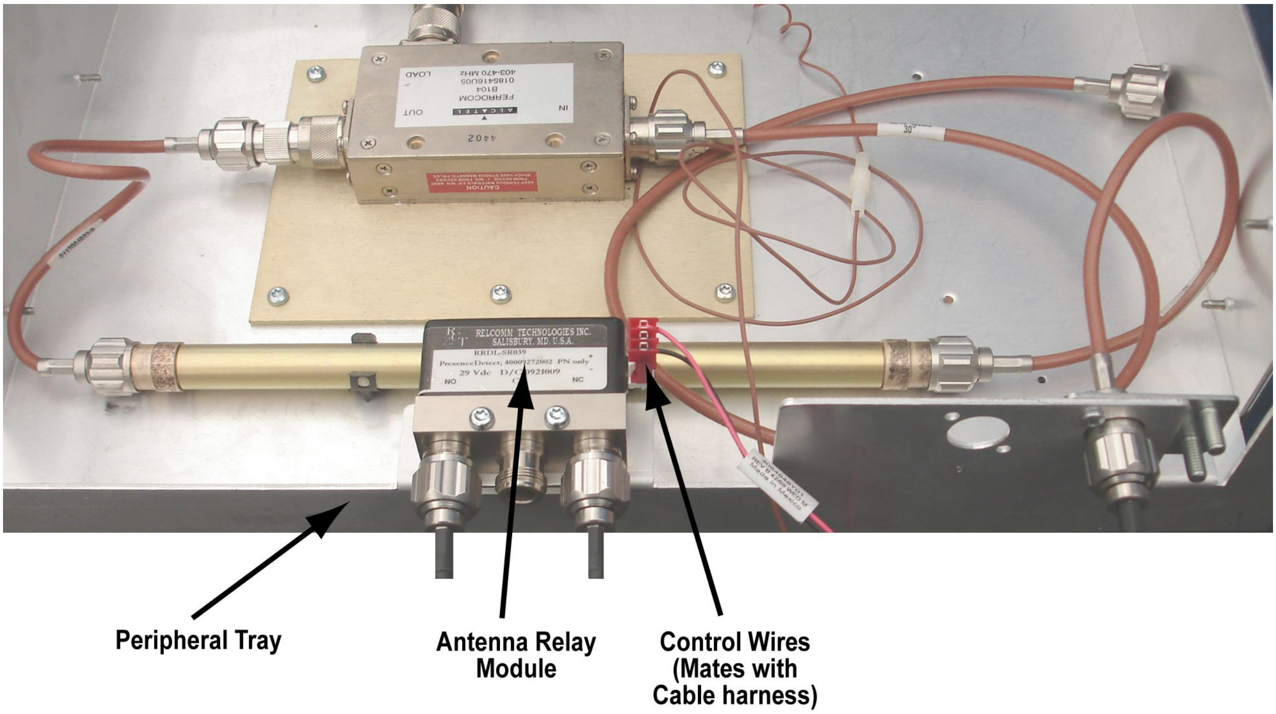


Figure 2-23 Antenna Relay Module Mounted on Backplane Cover



On base radios **equipped** with the peripheral tray, the antenna relay is mounted on the peripheral tray as shown in Figure 2-24.

Figure 2-24 Antenna Relay Module Mounted on Peripheral Tray



Functional Operation

The antenna relay module contains a relay with a set of normally open and normally closed contacts. The relay coil is controlled by a signal from the transceiver module that connect to Receiver input port Rx-A or the PA deck to a single transmit/receive antenna.

NOTE

Note that with the relay de-energized, the antenna is connected to Receiver input port Rx-A. To connect the antenna to the PA deck, the transceiver module must energize the relay.

Figure 2-25 shows a functional block and interconnect diagram for the antenna relay module using a bracket mounting.

Figure 2-25 Functional Block and Interconnect Diagram for Antenna Relay Module (Bracket Mounting)

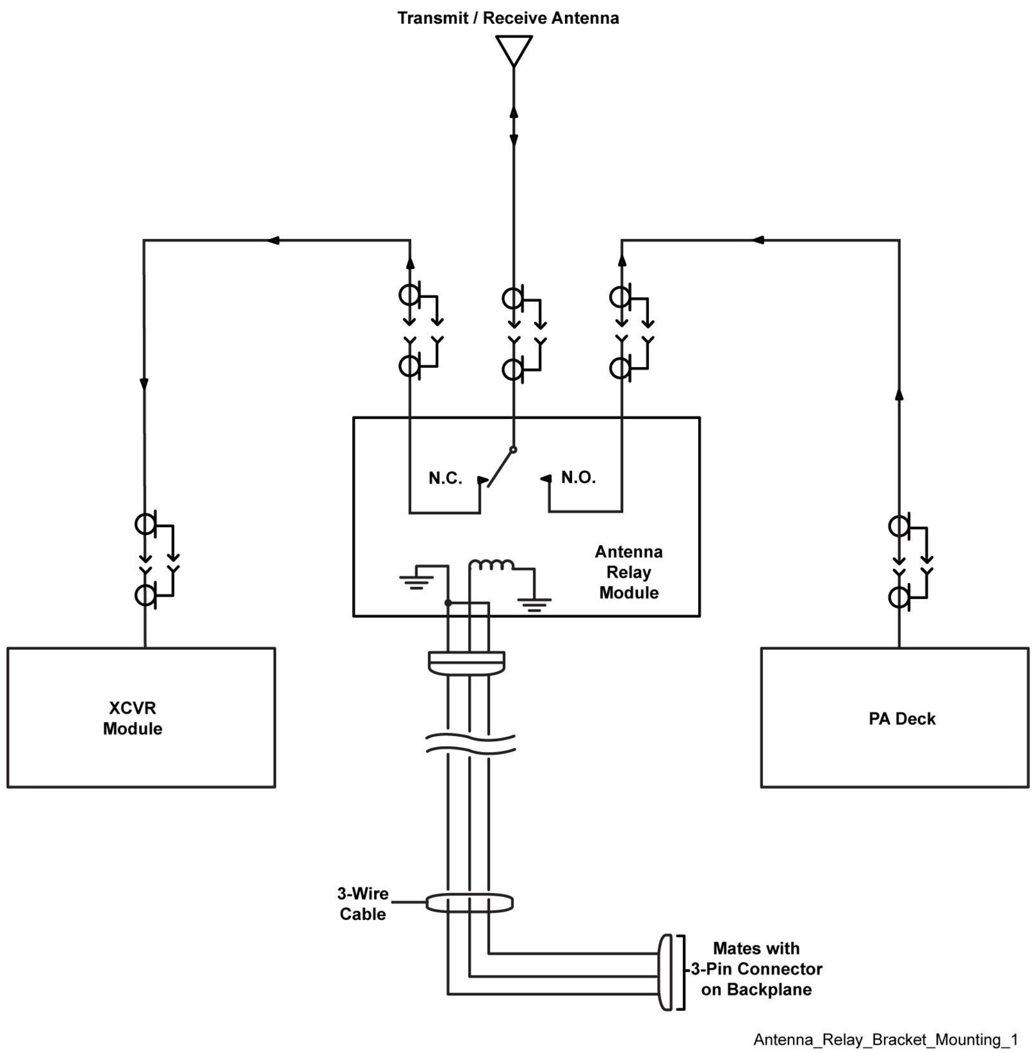
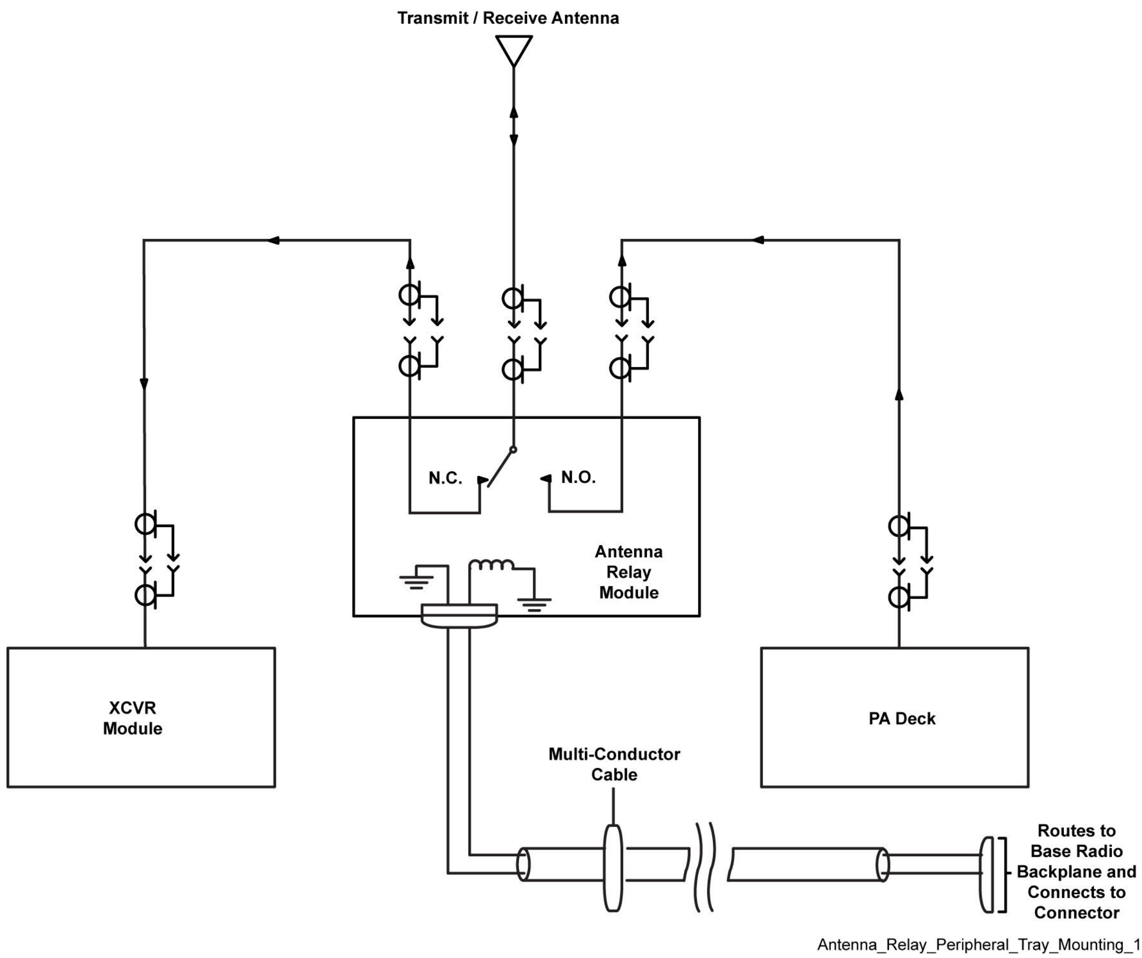


Figure 2-26 shows a functional block and interconnect diagram for the antenna relay module using a peripheral tray mounting.

Figure 2-26 Functional Block and Interconnect Diagram for Antenna Relay Module (Peripheral Tray Mounting)



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Chapter 3

GTR 8000 Base Radio Installation

This chapter details installation procedures relating to GTR 8000 Base Radio.

Pre-Installation Tasks

Follow Process 3-1 to perform the installation tasks. Make sure you have the following:

- appropriate cables
- access to SWDL, CSS, and UNC
- IP/DNS information
- login and password information

Process Overview

Process 3-1 provides a general description of the installation process.

Process 3-1 Equipment Installation Process

1	Prepare the site to comply with the Motorola requirements and specifications for the equipment, as listed in the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50). Other codes and guidelines that may apply to the location must also be met. See "General Safety Precautions" on page 3-2.
2	Inspect and inventory all racks, cabinets, cables, and other equipment with a Motorola representative to ensure that the order is complete. See "General Installation Standards and Guidelines" on page 3-8.
3	A variety of tools are needed to install and service the equipment. If information is needed regarding where to obtain any of the equipment and tools listed, contact the Motorola System Support Center (SSC). See "General Installation/Troubleshooting Tools" on page 3-15 for a list of general recommended tools for installing and servicing the hardware.

Process 3-1 Equipment Installation Process (Continued)

4	Install all equipment using the site drawings and other documents provided by the Field Engineer. Use the installation standards and guidelines for placing and installing equipment.
5	Properly ground all the racks and cabinets to protect against ground faults, electrical surges, and lightning. See "GTR 8000 Base Radio Hardware Installation" on page 3-18.
6	Connect all necessary cables within a rack and between the racks for system interconnection. See "Connections – Rear (Integrated Voice & Data)" on page 3-27, "Connections – Rear (HPD)" on page 3-29, and "Transceiver Ports – Front" on page 3-30.
7	Run a preliminary check of a site before applying power.
8	See "GTR 8000 Base Radio Software Installation Prerequisites" on page 3-41 for a list of items you need access to prior to installing the software.
9	See "Device Installation using the UNC" on page 3-44 to discover the base radio and to load OS software images from the UNC.
10	See “Chapter 4, Configuring the GTR 8000 Base Radio Using CSS” to program the configurations into the base radio using CSS.
11	See “Chapter 4, Using VoyenceControl to Configure Centralized Authentication on Devices” to program the base radio using UNC.

General Safety Precautions

CAUTION

Compliance with FCC guidelines for human exposure to Electromagnetic Energy (EME) at Transmitter Antenna sites generally requires that Personnel working at a site shall be aware of the potential for exposure to EME and can exercise control of exposure by appropriate means, such as adhering to warning sign instructions, using standard operating procedures (work practices), wearing personal protective equipment, or limiting the duration of exposure. For more details and specific guidelines, see Appendix A of the R56 Standards and Guidelines for Communications Sites (6881089E50) manual.

Observe the following general safety precautions during all phases of operation, service and repair of the equipment described in this manual. Follow the safety precautions listed below and all other warnings and cautions necessary for the safe operation of all equipment. Refer to the appropriate section of the product service manual for additional pertinent safety information. Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modifications of equipment.

NOTE

The installation process requires preparation and knowledge of the site before installation begins. Review installation procedures and precautions in the Motorola R56 manual *Standards and Guidelines for Communications Sites* (6881089E50) before performing any site or component installation.

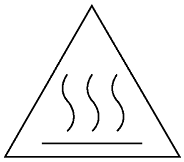
Always follow all applicable safety procedures, such as Occupational Safety and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices, and good judgment must be used by personnel. General safety precautions include the following:

- Read and follow all warning notices and instructions marked on the product or included in this manual before installing, servicing, or operating the equipment. Retain these safety instructions for future reference.
- If troubleshooting the equipment while power is on, be aware of the live circuits.
- Do not operate the radio transmitters unless all RF connectors are secure and all connectors are properly terminated.
- All equipment must be properly grounded in accordance with the Motorola R56 manual *Standards and Guidelines for Communications Sites* (6881089E50) and specified installation instructions for safe operation.
- Slots and openings in the cabinet are provided for ventilation. Do not block or cover openings that protect the devices from overheating.
- Only a qualified technician familiar with similar electronic equipment should service equipment.
- Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.
- Maintain emergency first aid kits at the site.
- Have personnel call in with their travel routes to help ensure their safety while traveling between remote sites.
- Institute a communications routine during certain higher risk procedures where the on-site technician continually updates management or safety personnel of the progress so that help can be dispatched if needed.
- Never store combustible materials in or near equipment racks. The combination of combustible material, heat and electrical energy increases the risk of a fire safety hazard.
- Equipment shall be installed in site meeting the requirements of a “restricted access location,” per UL60950-1, which is defined as follows: "Access can only be gained by service persons or by user who has been warned about the possible burn hazard on equipment metal housing. Access to the equipment is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.”

WARNING

Burn hazard. The metal housing of the product may become extremely hot. Use caution when working around the equipment.

Figure 3-1 Warning Label on Hot Modules



warning_hot

CAUTION

All Tx and Rx RF cables' outer shields must be grounded per Motorola R56 requirements.

CAUTION

DC input voltage shall be no higher than 60VDC. This maximum voltage shall include consideration of the battery charging "float voltage" associated with the intended supply system, regardless of the marked power rating of the equipment. Failure to follow this guideline may result in electric shock.

CAUTION

All Tx and Rx RF cables shall be connected to a surge protection device according to Motorola R56 documents. Do not connect Tx and Rx RF cables directly to outside antenna.

WARNING

RF energy burn hazard. Disconnect power in the cabinet to prevent injury while disconnecting and connecting antennas.

IMPORTANT

All equipment must be serviced by Motorola trained personnel.

DC Mains Grounding Connections

CAUTION

This equipment is designed to permit the connection of the earthed conductor of the DC supply circuit to the earthing conductor at the equipment. If this connection is made, all of the following conditions must be met:

- This equipment must be connected directly to the DC supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus in which the DC supply system earthing electrode conductor is connected.
- This equipment must be located in the same immediate area (such as, adjacent cabinets) as any other equipment that has a connection between the earthed conductor of the same DC supply circuit and the earthing conductor, and also the point of earthing of the DC system. The DC system must not be earthed elsewhere.
- The DC supply source is to be located within the same premises as the equipment.
- Switching or disconnecting devices must not be in the earthed circuit conductor between the DC source and the point of connection of the earthing electrode conductor.

Disconnect Device — Permanently Connected

A readily accessible disconnect device (circuit breaker or switch) must be incorporated in the building installation wiring.

Multiple Power Source

This product has multiple power sources. If service requires the removal of a power source, disconnect all inputs (AC and DC powers) to remove power completely to the equipment before servicing.

Connection to Primary Power

For supply connections, use wires suitable for at least 75°C.

Replaceable Batteries

CAUTION

Risk of Explosion if Battery is replaced by an incorrect type. Dispose of Used Batteries According to the Instructions.

Maintenance Requiring Two People

Identify maintenance actions that require two people to perform the repair. Two people are required when:

- A repair has the risk of injury that would require one person to perform first aid or call for emergency support. An example would be work around high voltage sources. A second person may be required to remove power and call for emergency aid if an accident occurs to the first person.

- Use the National Institute of Occupational Safety and Health (NIOSH) lifting equation to determine whether one or two person lift is required when a system component must be removed and replaced in its rack.

Equipment Racks

Equipment racks should only be lifted without the use of lifting equipment when sufficient personnel are available to ensure that regulations covering health and safety are not breached. Motorola recommends the use of an appropriate powered mechanical lifting apparatus for moving and lifting the equipment racks. In addition to these points, refer to and comply with any local regulations that govern the use of lifting equipment.

WARNING

Crush hazard could result in death, personal injury, or equipment damage. Equipment racks can weigh up to 360 kg (800 lb.). Follow the instructions below for proper lifting procedures.

Lifting Equipment Racks Horizontally

In some cases, equipment racks are shipped in the horizontal position. Use the appropriate lifting apparatus to lift the racks upright. Comply with all applicable health and safety regulations, and any other regulations applicable to lifting heavy equipment.

Do not use the eye nuts mounted on the top of the rack to lift the rack upright from a horizontal position. The eye nuts are not designed to lift horizontally and could fail resulting in damage to equipment or injury to personnel if used improperly.

WARNING

Crush hazard: could result in death, personal injury, or equipment damage.

Lifting Equipment Racks Vertically

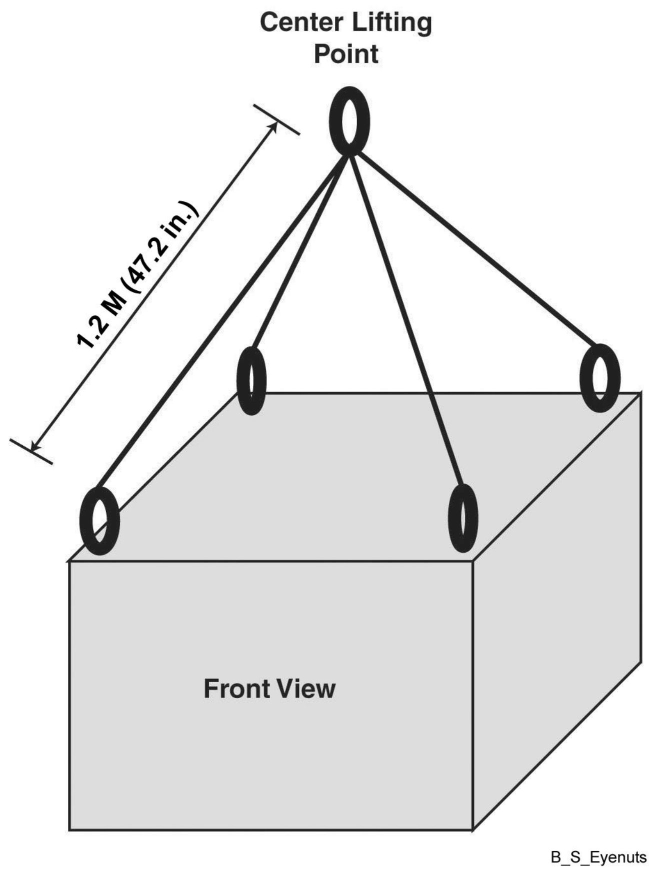
Some equipment racks have four M10 eye nuts mounted in the top of the rack. Use these eye nuts to lift the equipment rack vertically. Before using these eye nuts, visually check them and the rack hardware for any damage that may have occurred during shipping.

WARNING

Do not use the eye nuts if damage is apparent. Contact Motorola for replacements.

Use all four eye nuts when lifting the equipment rack. The minimum distance from each eye nut to the lifting point must be 1.2 meters (47.2 in). Using a shorter length than that specified could cause the eye nuts to fail. Figure 3-2 shows the minimum lengths and proper lifting angles using the eye nuts.

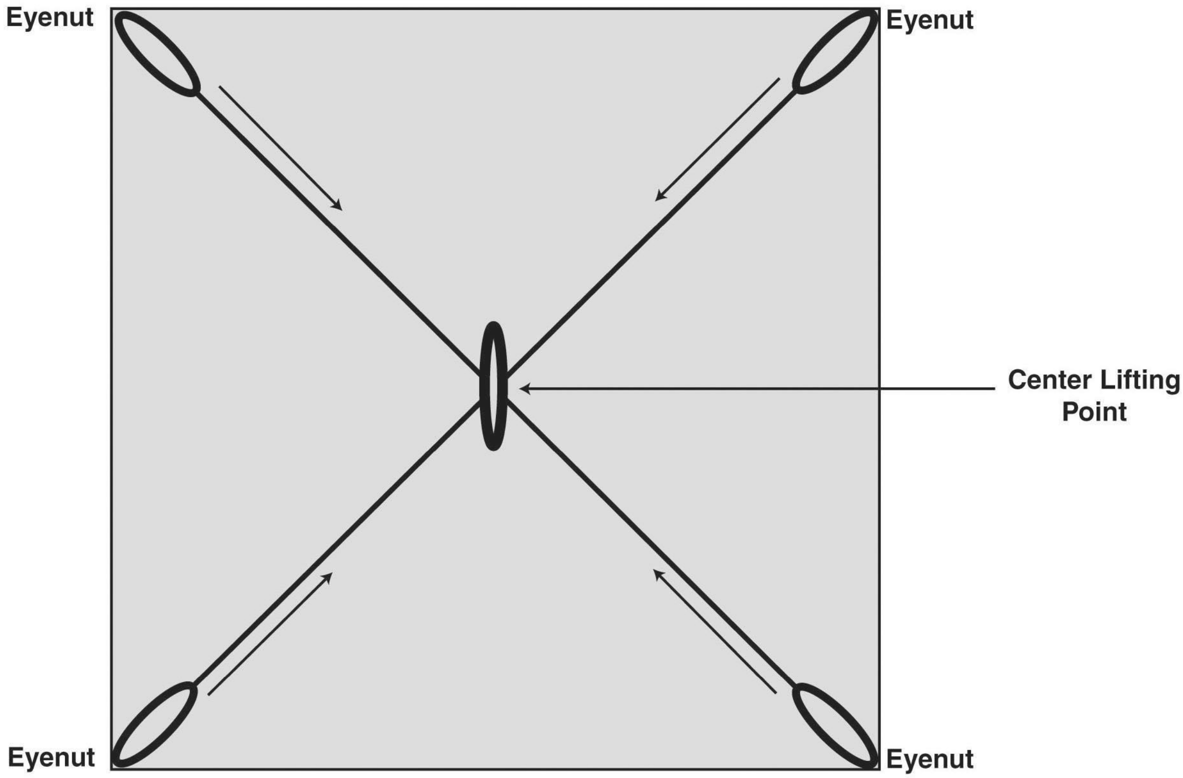
Figure 3-2 Lengths and Angles for Lifting Using the eye nuts



If eye nuts are removed or become loose, install them properly before lifting the equipment rack. Tighten the eye nuts and bolt assembly by hand. Correct eye nut tightness and alignment are crucial to ensure the eye nut assembly performs to its intended lifting capacity. The eye nuts must be aligned to point towards the center lifting point of the cabinet and tightened to between 90 to 120 in-lbs torque.

Figure 3-3 shows the proper alignment of the eye nuts.

Figure 3-3 Proper Alignment of the eye nuts



General Installation Standards and Guidelines

This section provides several guidelines to ensure a quality install. Review these guidelines before unpacking and installing the system. Additionally, review the installation information in the Motorola R56 manual*Standards and Guidelines for Communication Sites* (6881089E50) for more details, including:

- Equipment installation
- Antenna installation

You should also review installation information specifically for GTR 8000 Base Radios and subsystems in "GTR 8000 Base Radio Hardware Installation" on page 3-18.

General Site Preparation Overview

Perform the activities listed in Table 3-1 to ensure proper site preparation. The table references specific chapters in the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50) for more information.

Table 3-1 Activities for Site Preparation

Activity	Description of Activity	Chapter Reference (68P81089E50)
Review the site plan.	• Prevents potential on-site and off-site interference by local trunked systems. • Minimizes cable lengths. • Determines the location of telecom equipment.	• Chapter 4 “Site Design and Development”
Determine site access and security.	Outlines of site access and security measures.	• Chapter 3 “Site Acquisition” • Chapter 4 “Site Design and Development”
Review safety considerations.	Outlines general, installation, and environmental safety guidelines and requirements as well as OSHA related considerations.	• Chapters 2 “Safety Summary” • Chapter 5 “Communications Site Building Design and Installation”
Schedule installation of telephone service.	Ensures options and functions of on-site, two-way communications for personnel safety and maintenance.	• Chapter 3 “Site Acquisition”
Review grounding specifications.	Ensures the site meets or exceeds the Quality Audit Checklist in Appendix F as well as the Power and Grounding Checklist in Appendix D.	• Chapter 6 “External Grounding” • Chapter 7 “Internal Ground” • Chapter 8 “Power Sources” • Chapter 9 “Transient Voltage Surge Suppression”
Schedule installation of site power.	Covers grounding, power sources, and surge protection.	• Chapters 6 “External Grounding” • Chapter 7 “Internal Ground” • Chapter 8 “Power Sources” • Chapter 9 “Transient Voltage Surge Suppression”

General Equipment Inspection and Inventory Recommendations

Motorola recommends that an inventory of all equipment is taken with a Motorola representative to ensure that the order is complete. Carefully inspect all equipment and accessories to verify they are in good condition. Promptly report any damaged or missing items to a Motorola representative.

WARNING

Do not tamper with factory configuration settings for these devices. This includes software configuration, firmware release, password, and physical connections. Motorola has configured and connected these devices to meet very specific performance requirements. Tampering with these devices may result in unpredictable system performance or catastrophic failure.

General Placement and Spacing Recommendations

The following are recommendations for placing equipment at a site:

- Place each rack on a firm, level, and stable surface and bolt the racks together.
- Use correct mounting hardware and shims to prevent rack movement.
- Use strain relief when installing and positioning cables and cords to help ensure that no interruption of service occurs.
- Provide an appropriate amount of space around all components to allow for proper air flow, cooling, and safe access to equipment.
- Locate the site racks and other equipment with enough spacing to allow access for service.

NOTE

Proper spacing of equipment is essential for ease of maintenance, and safety of personnel. Spacing requirements have been established to meet the National Fire Protection Associations (NFPA) Code, and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) standards. Also adhere to any local regulations that apply to the installation.

- Locate the system in an area that is free of dust, smoke, and electrostatic discharge (ESD).
- See the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50) for details on these space requirements.

General Cabinet Bracing Recommendations

Use all supplied bracing hardware when installing a rack or cabinet and secure all equipment within a rack or cabinet.

If additional equipment needs to be installed, refer to the system design document provided by the field engineer or consult the Motorola Field Representative.

Subsystem cabinets are self-supporting structures. In areas subject to seismic activity, additional bracing of the cabinet may be required to prevent it from tipping. However, the bracing hardware must be locally procured. There are no specific procedures within this manual for bracing cabinets in active seismic areas.

General Floor Mounting Procedure for Cabinets or Racks

Perform the following steps to properly install a subsystem cabinet or open rack within a site building: Cabinets and racks must be secured to the floor for optimum stability. This procedure is written so that the cabinet is moved only once.

Procedure 3-1 How to Mount a Cabinet or Open Rack to the Floor

1	Carefully mark the mounting holes with a pencil, as indicated on the appropriate cabinet or rack footprint.
2	Drill the marked mounting holes to the appropriate depth of the mounting hardware with a hammer drill and bit.
3	Insert an anchor into the drilled hole. If necessary, tap the anchor into place using a hammer.
4	For cabinets, remove the four screws securing the bottom kick panel to the front and back of the cabinet. Remove the kick panel and set aside during installation.
5	Carefully move the cabinet or rack into the position indicated by the holes in the floor. **WARNING** **Equipment cabinets and racks are heavy and may tip. Use extreme caution when moving. Lift from top eye nuts with appropriate apparatus or secure the cabinet or rack from tipping if lifting from bottom. Failure to do so could result in death or serious injury or equipment damage.**
6	Adjust and level the cabinet or rack as necessary to position the cabinet mounting holes with the pre-drilled holes.
7	Secure the cabinet or rack to the site floor with the locally procured mounting hardware. **IMPORTANT** If the cabinet or rack is to be secured to a concrete floor, 1/2–inch grade 8 bolts with anchors are recommended.

General Bonding and Grounding Requirements

Cabinets and racks include a rack grounding bar (RGB) with the capacity to terminate numerous ground wires. Equipment added to the cabinet or rack should be attached to the ground bar using solid or stranded 6 AWG copper wire.

The RGB uses dual-hole lugs to terminate ground wires. The minimum number of dual-hole attachments is system dependent and is specified by your organization. This bar provides electrical continuity between all bonds and ground wire with a current carrying capacity equal to or exceeding that of a 6 AWG copper wire.

See the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50) for more information on proper bonding and ground at a site.

General Cabling Requirements

Diagrams for cabling are typically included in the System-specific configuration documentation provided by Motorola. Also see the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50) for cabling standards.

IMPORTANT

System certification was completed using shielded cables. To prevent emission problems, use only shielded cables. Do not substitute other cable types.

- Ensure equipment is positioned to avoid excessive tension on cables and connectors. Cables must be loose with absolutely no stress on the connectors. Careful cable routing and securing the cables with tie wraps (or other devices) is one way to provide this protection. Maintenance loops are recommended.
- Dress the cables neatly using cable ties. Do not tighten the cable ties until you are sure that the required service length and bend radius requirements are met. Cable ties should be loose enough to allow adjustment.
- Verify that all cables are properly labeled to match System-specific configuration documentation provided by Motorola.
- Ensure that cables do not exceed the minimum bend radius as outlined in the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50).

NOTE

For more information on cabling guidelines, see the documentation supplied with components from each equipment manufacturer.

WARNING

Use only Category 5 Shielded Twisted Pair (or higher) for cabling Ethernet connections. Motorola has engineered this system to meet specific performance requirements. Using other cabling and connectors may result in unpredictable system performance or catastrophic failure.

General Power Guidelines and Requirements

Follow the guidelines in the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50) for information on providing electrical service, power budgeting, selecting batteries, and other topics for supplying power at the site.

Electrical installation work shall be carried out in accordance with the current edition of the NFPA 70 and local building codes. Where required, only a qualified and licensed electrician shall be used for all electrical installations.

General AC Power Guidelines and Requirements

The Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50) defines the guidelines and requirements for cabinets and racks that house equipment that requires AC power input. Some of the guidelines and requirements are as follows:

- The cabinet or rack is designed to accept 120/240 V, single-phase power with an amperage service size as required by the electronic equipment.
- Cabinets and racks serviced by commercial power must be equipped with a nationally recognized test laboratory (NRTL) certified power distribution module that contains a main circuit breaker or individual circuit breakers of the correct size as required for the electronic equipment or specified by your organization.
- A decal showing an electrical schematic of the power wiring is affixed to the inside surface of the cabinet.
- All AC power equipment and electrical components must conform to National Electrical Manufacturers Association (NEMA) and National Electrical Code (NEC). These must also be listed by an NRTL.
- A surge arrestor, designed to protect equipment systems from a 120/240 V service and load center, is placed on the power feed ahead of all individual load center circuit breakers. This gapless arrestor must be listed by an NRTL for the purpose intended.
- Selection of a surge arrestor is based on the susceptibility of the equipment powered by the electrical service, with margin provided for locally generated disturbances. See ANSI/IEEE C62.41 (21) for more details.
- At least one 120 V AC, 15 A duplex convenience outlet equipped with ground fault interrupter (GFI) protection must be provided in the electronic equipment compartment.

CAUTION

Do not use surge/transient suppressors without careful and expert power system analysis.

SUGGESTION

Redundant devices could be terminated on different AC main phases so that a single phase failure does not result in a power loss for both devices.

General Breaker Recommendations

Each base radio power supply should have its own supply breaker in order to ensure that a fault which causes the breaker to open does not result in the loss of multiple transmit channels. The breaker recommendations for AC and DC supply breakers are as follows:

- For a 120 VAC, 60 Hz application, the AC supply breaker should be rated for a continuous current of 20A. For a 220VAC, 50Hz application, the AC supply breaker should be rated for a continuous current of 10A minimum, not to exceed 20A.
- Individual DC breakers are not used in the base radio architecture. For information involving the sizing of cables and DC power distribution, please refer to the Motorola R56 manual standard in the *Standards and Guidelines for Communication Sites* (6881089E50).
- Site installation shall include a single current interrupting device on the DC input distribution (fuse or circuit breaker) rated for the application loading, not to exceed 200A. For each standalone base radio , the DC supply breaker should be rated for a continuous current of 25A.

General Battery Installation Recommendations

The batteries and charger should be as close as possible to the rectifier system using the cables. A very heavy gauge stranded cable is advised to minimize voltage drop. The resistance of some heavy gauge wire is:

Table 3-2 Heavy Gauge Wire Resistance Examples

Gauge	Resistance
#6 gauge	0.3951 Ω/1000 ft
#4 gauge	0.2485 Ω/1000 ft
#2 gauge	0.1563 Ω/1000 ft

The maximum voltage drop can be calculated by knowing the peak current drawn by the radio system. Use the following formula:

Total Voltage drop = [Ω/1000 ft] x [total loop length (ft)] x [Ipeak (A)] + [connector(s) voltage drop(s)]

See the “DC Power Connection Wire Gauge Calculations for Integrated Voice & Data” section of the documentation for additional guidelines on cable sizing.

General Electrostatic Discharge Recommendations

Electronic components, such as circuit boards and memory modules, can be extremely sensitive to electrostatic discharge (ESD). Motorola recommends that an antistatic wrist strap and a conductive foam pad be used when installing or upgrading the system.

If an ESD station is not available, wear an antistatic wrist strap. Wrap the strap around the wrist and attach the ground end (usually a piece of copper foil or an alligator clip) to an electrical ground. An electrical ground can be a piece of metal that literally runs into the ground (such as an unpainted metal pipe) or the metal part of a grounded electrical appliance. An appliance is grounded if it has a three-prong plug and is plugged into a three-prong grounded outlet.

NOTE

Do not use a computer as a ground, because it is not plugged in during installation.

FCC Requirements

Radio frequency (RF) transmitters installed at sites within the US must be in compliance with the following FCC regulations:

- The station licensee shall be responsible for the proper operation of the station at all times and is expected to provide observations, servicing and maintenance as often as may be necessary to ensure proper operation.
- The transmitter ERP shall not exceed the maximum power specified on the current station authorization.
- The frequency of the transmitter must be checked during initial installation of the transmitter, when replacing modules, or when making adjustments that affect the carrier frequency or modulation characteristics.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference to radio communications when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy. If not installed properly and used in accordance with the instruction manuals, the equipment may cause harmful interference to radio communications. Operation of some compliant equipment in a residential area may cause harmful interference to radio communications, in which case the user is required to correct the interference.

Networking Tools

The following is a list of recommended networking tools for installing and servicing the network:

- Fluke® OneTouch Assistant LAN tester
- Ni-MH rechargeable battery for Fluke
- T1/E1 or E1 test set (such as the Hewlett-Packard® HP37702A)
- Serialtest® software with ComProbe® and SerialBERT option

General Installation/Troubleshooting Tools

The following is a list of general tools needed for site installation activities. If information is needed regarding where to obtain any of the equipment and tools listed, contact the Motorola System Support Center (SSC). See “Using Motorola System Support Center (SSC)”.

General Tools

The following is a list of general tools needed to install, optimize, and service equipment in the system:

- 150 MHz 4 Channel Digital Storage Oscilloscope
- Transmission Test Set (TIMS Set)
- Aeroflex 3900 Series Service Monitor
- 50 Ohm Terminated Load
- Digital Multimeter (DMM)
- Terminal Emulation Software
- DB-9 straight through serial cable
- RS-232 Cables with Connectors
- Punch Block Impact Tool
- MODAPT — RJ–45 Breakout Box
- Remote RJ–11/ RJ–45 Cable Tester (1200 ft. length maximum)
- PC Cable Tester (RG–58, 59, 62, BNC, RJ–45, RJ–11, DB–9, DB–15, DB–25, Centronics 36–pin connectors
- ESD field service kit
- Amprobe Instruments GP-1 Earth Tester
- AEMC 3730 Clamp-on Ground Resistance Tester

Base Radio Rack Tools

The following is a list of tools needed to install, optimize and service the base radio equipment:

- Service Monitor: Aeroflex 3900 Series Service Monitor with P25 Options installed (plus HPD & TDMA options as required)
- Personal Computer meeting the following specifications:
  - Operating Systems:
    - Windows XP Home Edition
    - Windows XP Professional
    - Windows Vista (all editions)
    - Windows 7 (all editions)

- Hardware Requirements:
  - Processor:
    - 1 GHz or higher Pentium grade
  - Processor Memory:
    - 1 GB RAM recommended for Windows XP
    - 2 GB RAM recommended for Windows Vista and Windows 7
  - Hard Disk Space:
    - 300 MB minimum free space (for a Typical Installation, including Help Text and Software Download Manager) or 100 MB minimum free space (for a Compact Installation)
  - Peripherals:
    - Microsoft Windows supported Mouse or Trackball
    - Microsoft Windows supported Serial Port for product communication
    - Microsoft Windows supported Ethernet Port for product communication
    - Microsoft Windows supported Printer Port for report printing
    - CD-ROM for software installation
- Configuration/Service Software (CSS) DLN6455
- CSS Serial Programming Cable - this is a DB-9 straight through serial cable (female DB-9 to male DB-9)
- Ethernet Cable
- Antenna tester
- 50 Ohm Terminated Load
- Rohde&Schwarz NRT-Z14 Directional Power Sensor 25-1000 GHz 0.1-120W. Recommended for all uses when a service monitor is not available.
- Refer to “Quick Connect RF Coaxial Adapters for GTR 8000 Base Radio Support” for a list of RF connectors that may be used.

Technical Support for Installation

Technical support is available from the site-specific documents provided by the Field Engineer or Motorola Field Representative for the system, one of the Motorola System Support Center (SSC), or qualified subcontractors.

- Motorola System Support Center (SSC) can help technicians and engineers resolve system problems and ensure that warranty requirements are met. Check your contract for specific warranty information. See “Using Motorola System Support Center (SSC)” in the Troubleshooting section of the documentation.

- The Motorola System Service Subcontractor Assessment program ensures that service people contracted by Motorola meet strict minimum requirements before they can work on any trunking systems. For more information on this program, contact the Motorola representative.

Site-Specific Information

When systems are staged by Motorola, site-specific system documentation is created to document how the system was staged. The Field Engineer assigned to the system creates all of the site-specific information including the following:

- Site design drawings showing the location of racks, cabinets, cable trays, and other components
- Rack drawings showing the location of the equipment in each rack
- Cable matrix in a table format that shows each cable and its connections
- Interconnect wiring diagrams to show the cable connections between devices
- Pre-programmed parameters of each site component
- Templates used to program each device
- All firmware and software revisions of each site component
- Test data from each device that requires operational verification
- Optimization requirements and settings of each electrical path
- Acceptance Test Plan for the site components

NOTE

This site-specific information must be maintained to reflect the current site configuration and layout for the system.

GTR 8000 Base Radio Hardware Installation

The following is information specific to GTR 8000 Base Radios.

Placement and Spacing

Cabinet and racks allow equipment to be added to a site. Always consider room for expansion when setting up a site. Cabinets or racks my be installed adjacent to each other or to other equipment. However, all cabinets and racks must have sufficient floor space to permit access for installation and service.

Recommended clearance for service and installation is at least 2 feet in the front and rear.

Front access:

- At least 2 feet floor access in front of the cabinet or rack.

Side and rear access:

- At least 2 feet floor access at the rear of the cabinet or rack, or
- At least 2 feet access on at least one side of the cabinet or rack, plus 6 inches at the rear of the cabinet or rack.

To maintain this clearance, the following is recommended:

- If there will be less than 2 feet rear access, do not install more than 2 cabinets or racks side by side, and allow at least 2 feet access on at least one side of each cabinet or rack.
- For the cabinet version, if there will be less than 2 feet rear access, do not install the optional rear door on the cabinet.

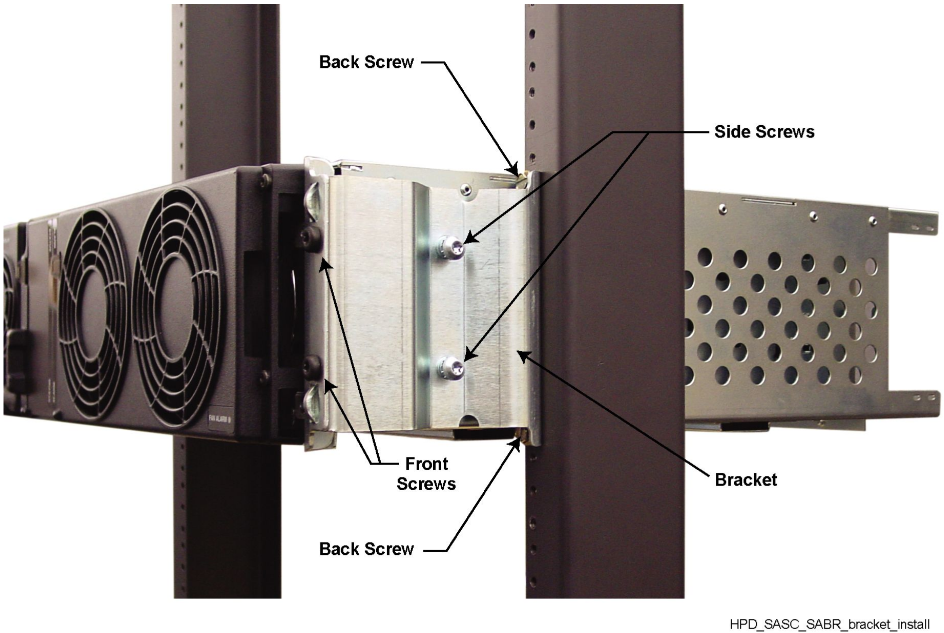
NOTE

For the cabinet version, in the event that an eye nut needs to be replaced, at least 2 feet access to both sides of the cabinet is preferable, so that both side panels can be removed.

Rack Mounting

The base radio/receiver housing mounts in a rack that has been secured to the floor. For open racks, two brackets are required to distribute the weight. Without brackets, the center of gravity of the system shifts to the back, potentially causing structural issues with the rack. Figure 3-4 shows the base radio attached to a rack using the brackets. The brackets come with the required number of screws.

Figure 3-4 Base Radio/Receiver Mounted in Rack



Procedure 3-2 explains how to mount the standalone GTR 8000 Base Radio into an open rack.

NOTE

It is suggested that two people perform this installation so that one person can hold the base radio/receiver in place while the other person attaches the brackets to the rack.

Procedure 3-2 How to Mount the Base Radio/Receiver

1	Determine where on the rack you will mount the device and mark the location. The brackets are useful in making this determination, and the pin on the back of the bracket helps in finding the exact location on the rack.
2	Attach the brackets to the sides of the device: • Use M6x1x13 machine screws with a captive washer (zinc plated). • Screw one bracket into the clinch nuts on the side of the device chassis. • Do the same with the second bracket: Screw it into the clinch nuts on the other side of the device chassis.
3	Lift the device into place on the rack using the pins on the brackets to properly line up the device.

Procedure 3-2 How to Mount the Base Radio/Receiver (Continued)

4	Next, attach the two brackets to the rack: • For a Motorola modular rack, use M6x1x10 thread forming screws with black finish. • For a Motorola open rack, use 12–24x5/8" thread forming screws (zinc plated). • For your own rack, use hardware appropriate for the rack. • Attach the brackets to both sides of the rack through the upper back openings on the brackets. • Through the lower back openings, attach the brackets to the rack on both sides.
5	In the front, attach the chassis to the brackets: • Screw two M6x1x10 thread forming screws (black finish) through the front holes on one side of the base radio chassis and into the bracket. • Screw two M6x1x10 thread forming screws (black finish) through the front holes on the other side of the base radio chassis and into the bracket.

Connecting Power

This section covers topics on connecting power cables to the base radio and calculating the length of wire for various gauges, and mounting the battery temperature sensor.

Connecting Power Cables to a GTR 8000 Base Radio

For standalone base radios, AC and DC inputs, provided by your organization, connect to the power supply through the backplane of the base radio. See "Connections – Rear (Integrated Voice & Data)" on page 3-27, "Connections – Rear (HPD)" on page 3-29, and "Transceiver Ports – Front" on page 3-30.

DC Power Connection Wire Gauge Calculations for Integrated Voice & Data

Since the power supply disconnects itself from the DC input when it senses that DC voltage has dropped to 42 VDC, it is important to minimize the voltage drop in the DC power supply loop (the total length of the 48 VDC "hot" wire and the DC return wire) to no more than 1 V total. This ensures that the maximum energy is removed from the battery prior to disconnecting the power supply from the DC input line.

A base radio transmitting at 100 W will draw up to 10 A* current when operating from a 54 V source (nominal 48 VDC system). As voltage decreases (due to the standby battery discharging) the current will increase proportionally (since the base radio appears to be a constant power load). At the low voltage disconnect point (42 V for a nominal 48 VDC system), the current will be up to 13 A*. If a single pair of 2 AWG wire is used to connect the battery to the back panel, the maximum length of a single conductor would be 75m (245 ft). Use of smaller gauge wire would reduce this length depending on the resistance of the wire.

* = The actual current value can be calculated from the power consumption value in the specifications tables. See Chapter 1, "GTR 8000 Base Radio Specifications".

To determine the maximum length of wire for wire other than 2 AWG, the following relationship can be used:

- Length (meter/feet) = V/I/R

where:

- V = voltage drop in one leg of the loop (max = 0.5V)
- I = current drawn by the base radio during DC operation
- R = resistance of the wire being considered (in Ohms per foot)

For common wire sizes, the maximum distances shown in Table 3-3 apply.

Table 3-3 DC Power Connection Wire Gauge Maximum Distances for Integrated Voice & Data

AWG	Resistance (ohm/304.8 meter/ 1000 ft)	Maximum Distance (for 13A)
2	0.1563	75m (245 ft)
3	0.1970	60m (195 ft)
4	0.2485	47m (155 ft)
5	0.3133	37m (120 ft)
6	0.3951	30m (95 ft)

DC Power Connection Wire Gauge Calculations for HPD

Since the power supply disconnects itself from the DC input when it senses that DC voltage has dropped to 42 VDC, it is important to minimize the voltage drop in the DC power supply loop (the total length of the 48 VDC “hot” wire and the DC return wire) to no more than 1 V total. This ensures that the maximum energy is removed from the battery prior to disconnecting the power supply from the DC input line.

A base radio transmitting at 50 W will draw up to 7.4 A current when operating from a 54 V source (nominal 48 VDC system). As voltage decreases (due to the standby battery discharging) the current will increase proportionally (since the base radio appears to be a constant power load). At the low voltage disconnect point (42 V for a nominal 48 VDC system), the current will be up to 9.5 A. Use of smaller gauge wire would reduce this length depending on the resistance of the wire. To determine the maximum length of wire for wire other than 2 AWG, the following relationship can be used:

- Length (feet) = V/I/R

where:

- V = voltage drop in one leg of the loop (max = 0.5V)
- I = current drawn by the base radio during DC operation (9.5A)
- R = resistance of the wire being considered (in Ohms per foot)

For common wire sizes, the maximum distances shown in Table 3-4 apply.

Table 3-4 Power Connection Wire Gauge Maximum Distances for HPD

AWG	Resistance (ohm/1000 ft)	Maximum Distance
2	0.1563	102m (335 ft)
3	0.1970	81m (265 ft)
4	0.2485	64m (210 ft)
5	0.3133	51m (165 ft)
6	0.3951	40m (130 ft)

Mounting the Battery Temperature Sensor

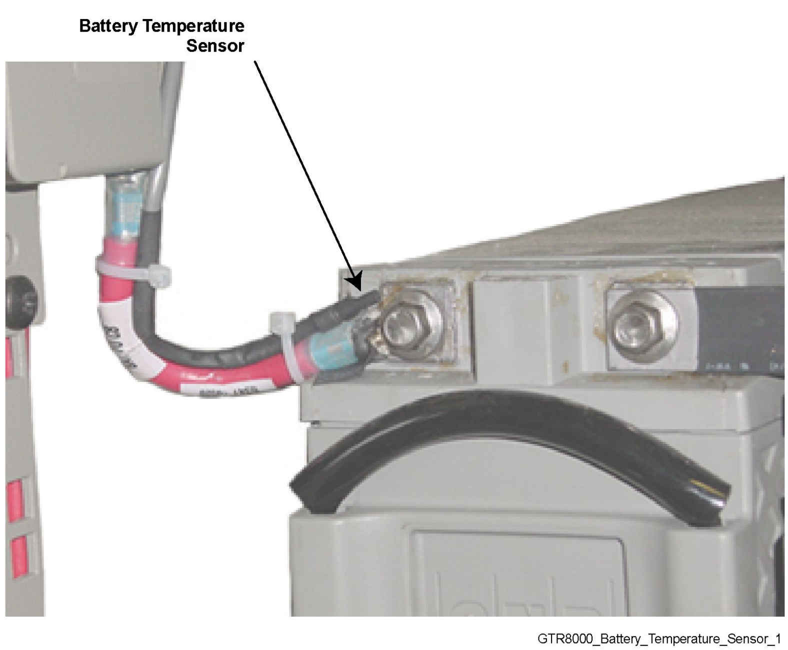
A 40–foot battery temperature sensor cable is shipped with your GTR 8000 Base Radio. This three-wire cable carries a voltage signal to the power supply from a sensor element which needs to be mounted in close proximity to the storage battery. Voltage is proportional to the battery temperature and is used by diagnostic circuitry in the power supply module. The 40–foot cable can be extended to a total length of 190 feet using 50–foot extensions (Motorola part number 3084827Y04). See “Using Motorola System Support Center (SSC)” in the Troubleshooting section of the documentation.

The sensing element of the temperature sensor needs to be mounted so that it detects the actual battery temperature (or the ambient temperature as close as possible to the batteries being charged). There are two examples of mounting:

Example 1

Use cable ties to attach the sensing cable to the positive (or negative) power cable. A minimum of two cable ties should be used (spaced 6 inches apart), with one of the cable ties not more than 2 inches from the sensing element. The sensing element itself should be not more than 2 inches from the battery post where the power cable connects. See Figure 3-5.

Figure 3-5 Battery Temperature Sensor Example 1



Example 2

Attach the sensing cable to an existing battery tray support bracket using cable ties or nylon loop straps of the proper size. The sensing element should be placed so that it is not more than 2 inches from the surface of the batteries being monitored. A minimum of two cable ties and/or loop straps should be used to secure the sensing cable to the bracket. The cable ties/ loop straps should be placed no more than 6 inches apart with one placed no more than 2 inches from the sensing element. See Figure 3-6.

Figure 3-6 Battery Temperature Sensor Example 2

Grounding

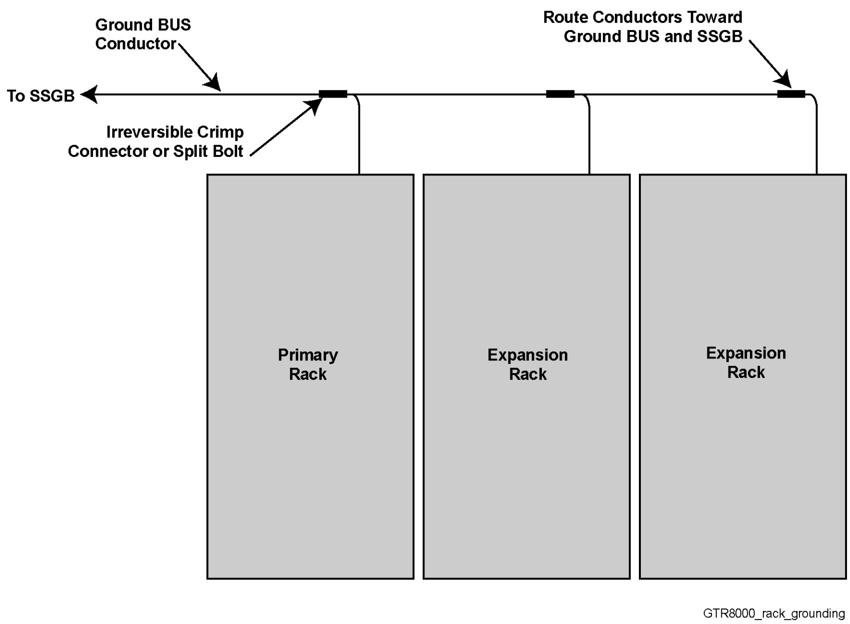
Detailed grounding information is beyond the scope of this manual. See the Motorola R56 manual *Standards and Guidelines for Communication Sites* (6881089E50) for detailed information about grounding and lightning protection.

IMPORTANT

You must ground the battery system, either positive or negative, at the battery. The DC input (battery charger output) of the power supply is floating with respect to earth ground. The power supply can therefore be used in either positive ground or negative ground DC systems. The appropriate terminal (+ or -) of the DC system should be connected to protective earth at the battery. These instructions assume that all telephone lines, antenna cables, and AC or DC power cables have been properly grounded and lightning-protected.

When rack installations have a primary rack and one or more expansion racks, all these racks must be connected to the same Sub System Ground Bus Bar (SSGB) (and no other rack connected to the SSGB). This is to ensure surge events do not produce ground potential differences that will affect signals between the racks. See Figure 3-7.

Figure 3-7 Rack Grounding



Base Radio/receiver Grounding

The base radio/receiver backplane has a double lug with two lock nuts on the rear panel where the ground wire connects to the base radio backplane on one end, and to the rack grounding bar on the other. The rack grounding bar is connected to the master ground bus bar.

To use the grounding lugs, you need a length of #6 AWG wire with UL-listed ring lugs on both ends. This wire is shipped with the base radio. Procedure 3-3 explains how to ground the base radio.

Procedure 3-3 How to Ground the Base Radio/Receiver

1	Take the ground wire already attached to the two grounding lugs at the rear of the base radio/receiver, and connect the other end to the rack grounding bar.
2	Tighten the ground lock nut to 60 inch-pounds (6.94 newton-meters).

Connections – Rear (Integrated Voice & Data)

The base radio/receiver connects to a site LAN switch port for this channel and to the transmit and receive paths. The connections for the device are shown in Figure 3-8 and Table 3-5.

Figure 3-8 Base Radio/Receiver – Integrated Voice & Data Backplane

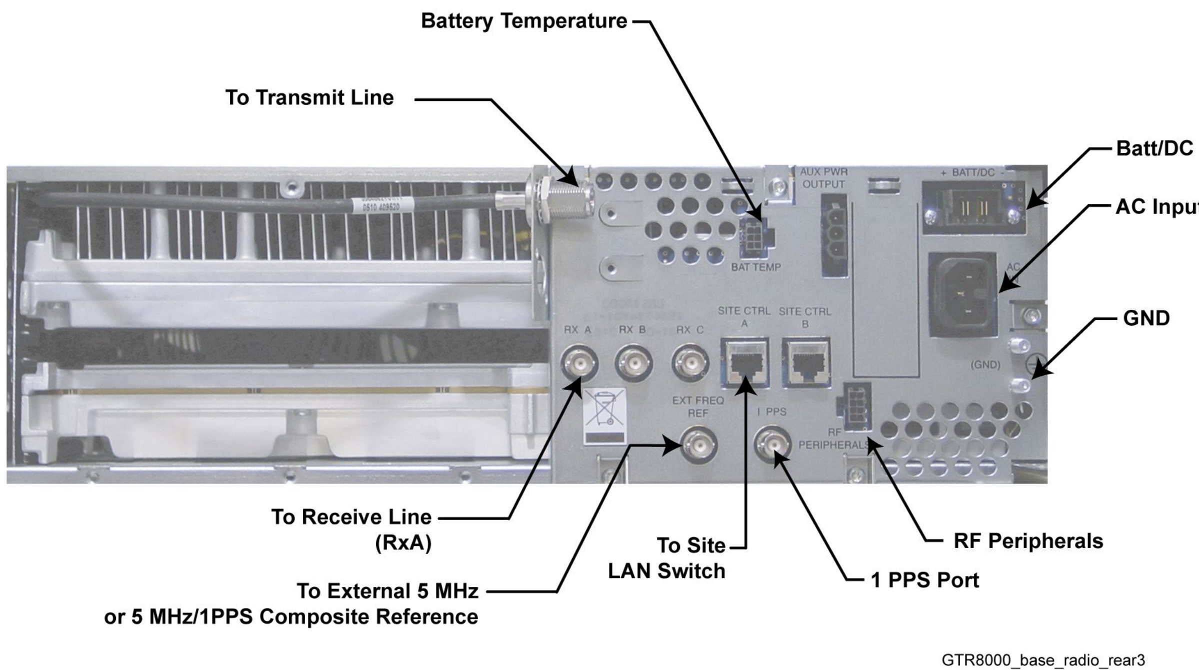


Table 3-5 Base Radio/Receiver Backplane Connections for Integrated Voice & Data

Port / Type	Device it connects to:	Port / Type	Description
SC-A port, RJ-45	Site LAN switch	Base radio port, RJ-45	IP interface connection to the site LAN switch port for this channel. An optional MOSCAD device connects to the site LAN switch that is connected to this port.
SC-B port, RJ-45			Not in use.
Rx-A, BNC	Receive line A	BNC	RF coax to receive path for antenna A.
Rx-B, BNC	Receive line B	BNC	RF coax to receive path for antenna B. This port is used for dual diversity for TDMA.
Rx-C			Not in use.
Transmit port, N-type	Transmit line	N-type	RF coax to transmit antenna.
Aux Pwr Output	Comparator	Aux Pwr Input	Connection to a conventional comparator for a conventional base radio.
Bat Temp, 6-pin	Battery temperature sensor		Connection to temperature sensor, allowing for temperature compensated battery charging.

Table 3-5 Base Radio/Receiver Backplane Connections for Integrated Voice & Data (Continued)

Port / Type	Device it connects to:	Port / Type	Description
RF Peripherals	RF peripheral sensor ports		Antenna relay and presence detect, external circulator load temperature (external wattmeter not supported).
Batt/DC	DC power supply or battery	Batt/DC	Input from and output to a 48 VDC power supply or backup battery. When AC power is not available, the device switches to operate from a DC source if the optional DC power (8AWG; length 9 ft), CA01400AA is ordered and installed. One end connects into the Batt/DC port and the other end connects into the DC source. The contacts are 39-83503N02 (AMP #53880-2), the receptacle housings are 15-83502N01 (AMP #53884-1) and the mounting ears are 07-83504N01 (AMP #53887-1). 3084869Y06 cable is used for a positive ground system. 3084869Y02 cable is used for a negative ground system.
AC	120/240 VAC power source.		Input from 120/240 VAC nominal power source.
EXT FREQ REF*	TRAK 9100	BNC	**Simulcast only:** Input for a composite (1 PPS +5 MHz) external site reference signal to drive internal oscillator for precise frequency stability and also an input for an accurate time source used for precisely launching simulcast data over the air.
	External frequency reference source		Input for a third party 5 or 10 MHz external frequency reference.
1 PPS*			Not in use. **NOTE** The 1 PPS port may be used to input a separate 1 PPS signal if the EXT FREQ REF port is programmed for 5 MHz only.

* See “GTR 8000 Base Radio Time and Frequency Inputs” in the Optimization chapter.

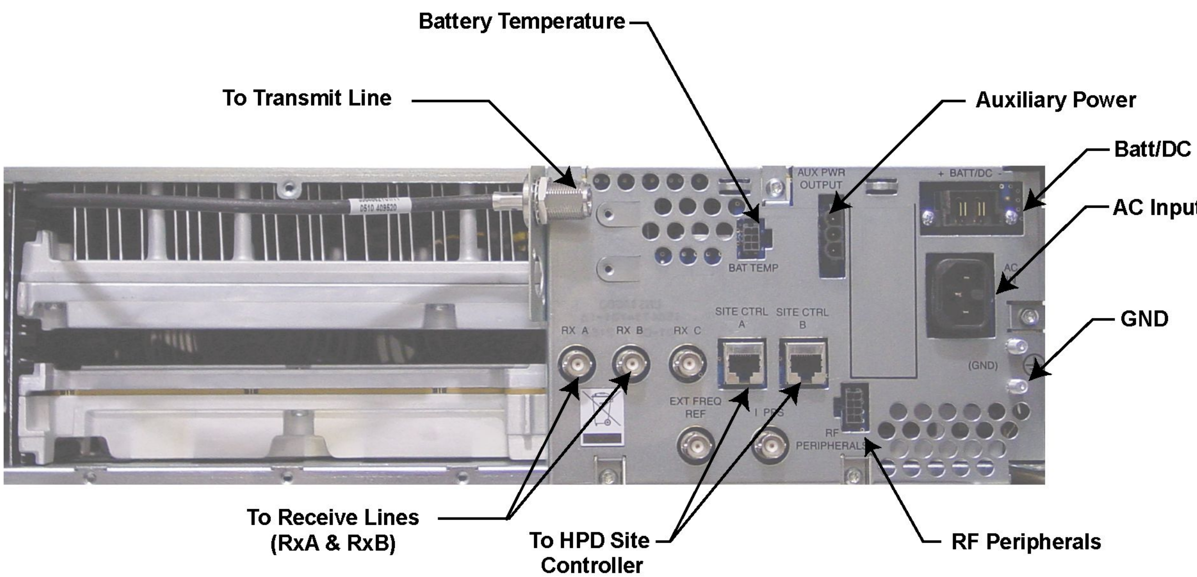
NOTE

The EXT FREQ REF input on the rear of the device is high impedance. An external termination is needed to properly terminate the cable connected to the input. It is recommended that a BNC "T" and a 50 Ohm BNC termination be connected to the input to terminate the cable. If the cable is daisy chained (multiple base radios connected together and driven by one TRAK/PSC output), only the last base radio in the chain has the termination.

Connections – Rear (HPD)

The base radio connects with each of the site controllers and to the transmit and receive paths. The connections for the base radio are shown in Figure 3-9 and Table 3-6.

Figure 3-9 Base Radio – HPD Backplane



HPD_GTR8000_base_radio_rear1

Table 3-6 Base Radio Backplane Connections for HPD

Port / Type	Device it connects to:	Port / Type	Description
SC A port, RJ-45	Site Controller module A	Base radio port, RJ-45	Connects to site controller A base radio port for this channel. **NOTE** The length of the cable between the site controller and the base radio should be no greater than 30 feet.
SC B port, RJ-45	Site Controller module B	Base radio port, RJ-45	Connects to site controller B base radio port for this channel.
Rx-A, BNC	Receive line A	BNC	RF coax to receive path for Rx antenna.
Rx-B, BNC	Receive line B	BNC	RF coax to receive path for antenna B.
Rx-C, BNC			Not in use
Transmit port, N-type	Transmit line	N-type	RF coax to transmit antenna.

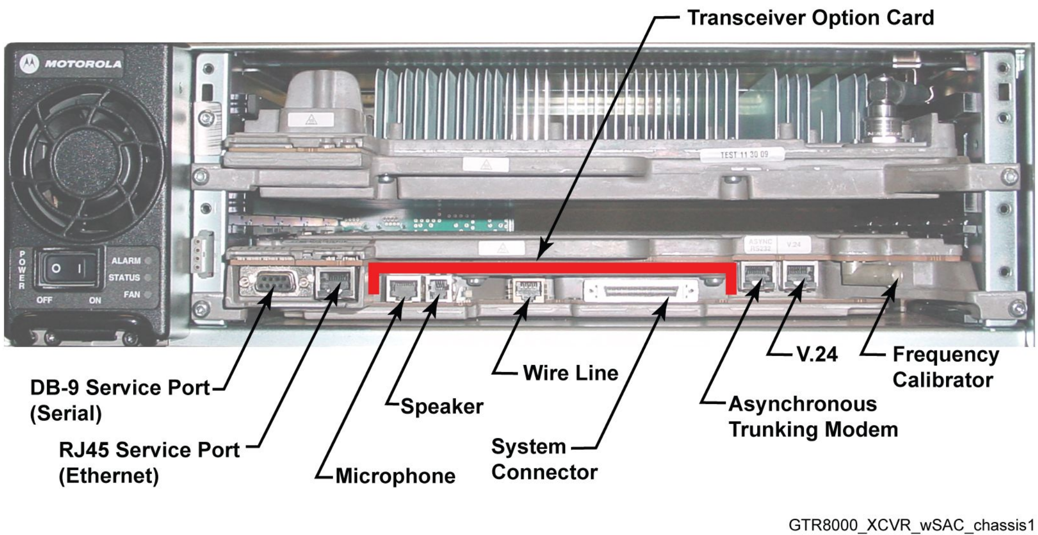
Table 3-6 Base Radio Backplane Connections for HPD (Continued)

Port / Type	Device it connects to:	Port / Type	Description
Aux Pwr Output	Site Controller or RMC/LNA	Aux Pwr Input	The auxiliary output power can be used to provide secondary power to the site controller or receive multicouplers (Site RMCs/LNAs).
Bat Temp, 6-pin	Battery temperature sensor		Connection to temperature sensor, allowing for temperature compensated battery charging.
RF Peripherals			Not in use
Batt/DC	DC power supply or battery	Batt/DC	Input from and output to a 48 VDC power supply or backup battery. Input from and output to a 48 VDC power supply or backup battery. When AC power is not available, the device switches to operate from a DC source if the optional DC power (8AWG; length 9 ft), CA01400AA is ordered and installed. One end connects into the Batt/DC port and the other end connects into the DC source. The contacts are 39-83503N02 (AMP #53880-2), the receptacle housings are 15-83502N01 (AMP #53884-1) and the mounting ears are 07-83504N01 (AMP #53887-1). 3084869Y06 cable is used for a positive ground system. 3084869Y02 cable is used for a negative ground system.
AC	120/240 VAC power source.		Input from 120/240 VAC nominal power source.
EXT FREQ REF			Not in use
1 PPS			Not in use

Transceiver Ports – Front

Two service ports are accessible through a drop-down door to the left of the fans. The remainder of the ports are behind the fan module. The front connections for the device are shown in Figure 3-10 and Table 3-7.

Figure 3-10 Base Radio/Receiver – Front



NOTE

The Transceiver Option Card is an optional board that attaches to the control board of a base radio or receiver. The board provides an internal 10 MHz frequency reference. For conventional base radio/receiver operation, it provides the analog interfaces and wild card I/Os.

Table 3-7 Transceiver Connections - Front

XCVR Port / Type	Connects to This Device/Port	Description
Ethernet service port, RJ-45	Service PC, LAN port	Ethernet service port for local access using Configuration/Service Software (CSS). Also may be used for localized software downloads. **NOTE** Supports only 10 Mb half duplex operation.
Serial service port, DB-9	Service PC, RS-232 port	Serial service port for initial configuration of the base radio IP address.
Microphone port, RJ-45	Microphone, RJ-45 port	Used to connect to a microphone with PTT button. **NOTE** Use microphone kit GMMN4063B.

Table 3-7 Transceiver Connections - Front (Continued)

XCVR Port / Type	Connects to This Device/Port	Description
Speaker port, RJ-9	External Speaker, RJ-9 port	Used to connect to an amplified (DC powered) external speaker. Audio volume level is set from the CSS. **CAUTION** **To prevent damage to the base radio, use speaker kits HSN1006A and cable part no. 0185180U01.**
Wireline port, RJ-45	Landline equipment, RJ-45 port	Connection between telephone lines and the analog conventional base radio. The wireline processes and routes all wireline audio signals between the base radio and landline equipment (such as consoles or modems).
	MLC 8000, RJ-45 port	E&M interface for 4–wire connections for analog operation.
System Connector, mini SCSI	50-pin Telco Connector	Connection for a conventional base radio/receiver. Provides the Wild Card I/Os and supplementary Analog I/Os for analog simulcast and special applications. Editing of Wildcard configurations is permitted only through CSS.
Asynchronous port, RS232, RJ-45		Not in Use
V.24 port	Channel Bank, RJ-45	Connection port when the base radio is part of a conventional circuit-based site, mixed mode or digital only.
	Digital Interface Unit, ASTRO-TAC 3000 Comparator, MLC 8000, or Conventional Channel Interface GGM 8000, RJ-45 port	V.24 interface connection port for a conventional base radio.
Reference frequency input, BNC*	Service monitor	Connection port to service monitor for frequency calibration.

* See “GTR 8000 Base Radio Time and Frequency Inputs” in the Optimization chapter.

NOTE

For information about conventional functions and topologies supported by the GTR 8000 base radio, see the *Conventional Operations* manual. Note that the base radio can be IP managed while using the 2– or 4–wire/V.24 interface for channel traffic.

System Connector Ports (Conventional)

The system connector is a 50-pin Mini SCSI connector. It is used for the Wildcard inputs, outputs, and the analog audio paths not routed to their own connector. See Table 3-8 for the system connector pin-out assignments and their function.

Table 3-8 50–Pin System Connector Pin-Outs (Conventional)

Pin #	Signal	Type	Function	Note
1	Aux In 2	Input	Main Standby - External handshaking	Pull To Ground To Activate
2	Aux In 4	Input	Main Standby- Status of other side	Pull To Ground To Activate
3	Aux In 6	Input	In-Cabinet Repeat	Pull To Ground To Activate
4	Aux In 8	Input	Main Standby - Connectivity other Station	Pull To Ground To Activate
5	Aux In 9 –	Input	Phone Patch - PL Strip	Opto-Isolated In - Current flow to Activate
6	Aux In 10 –	Input	Phone Patch - Monitor	Opto-Isolated In - Current flow to Activate
7	Aux In 11 –	Input		Opto-Isolated In - Current flow to Activate
8	Aux In 12 –	Input		Opto-Isolated In - Current flow to Activate
9	Aux In 13	Input	For future use	Pull To Ground To Activate
10	Aux Out 12	Output		Low Impedance to Ground When Active
11	Aux Out 2	Output	Phone Patch - Rx Carrier	Low Impedance to Ground When Active
12	Aux Out 4	Output	Main Standby - Station Status	Low Impedance to Ground When Active
13	Aux Out 6	Output		Low Impedance to Ground When Active
14	Aux Out Relay 7 Com	Output	RD STAT - Receiver Active	Form Relay A Closed When Active
15	Aux Out Relay 8 Com	Output	Main Standby - Antenna Relay	Form Relay A Closed When Active
16	Aux Out Relay 9 Com	Output		Form Relay A Closed When Active

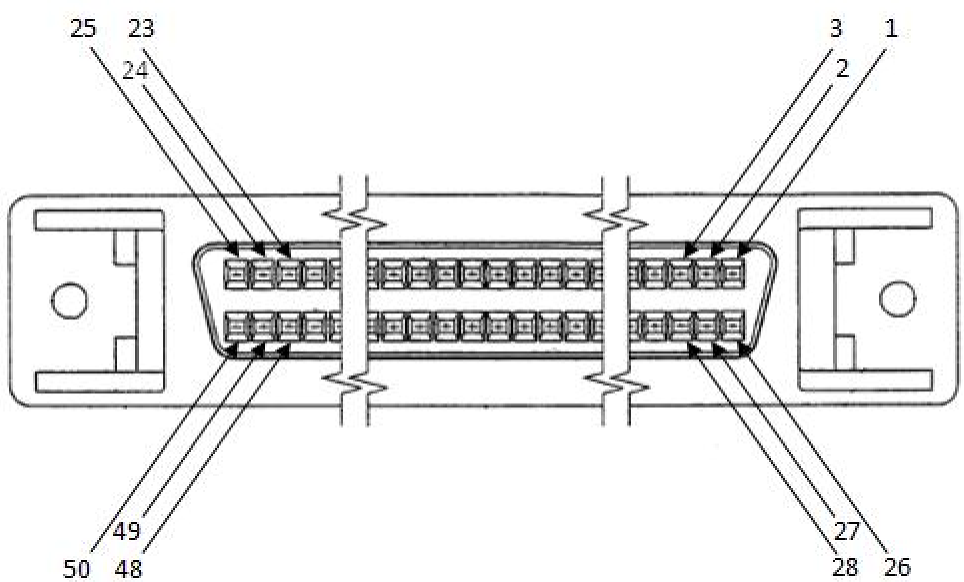
Table 3-8 50–Pin System Connector Pin-Outs (Conventional) (Continued)

Pin #	Signal	Type	Function	Note
17	Aux Out Relay 10 Com	Output		Form Relay A Closed When Active
18	Aux Out 11	Output		Low Impedance to Ground When Active
19	External_Reset	Input	Reset	Buffered Input Pull To Ground To Activate
20	TSTAT	Output	For future use	0 Volts When Inactive / +5 Volts when Active
21	AUX RX	Output	Aux Rx	Analog Signal – 600 Ohm Unbalanced
22	TX DATA –	Input	For future use	Analog Signal
23	AUX TX	Input/ Output	Aux Rx	Analog Signal – 600 Ohm Unbalanced
24	PL -	Input	PL(-) In	Analog Signal – 600 Ohm Unbalanced
25	Gen TX –	Input	Gen TX Data-	Analog Signal – 600 Ohm Unbalanced
26	Aux In 1	Input	Phone Patch - Call Request	Pull To Ground To Activate
27	Aux In 3	Input	Tx Inhibit	Pull To Ground To Activate
28	Aux In 5	Input	External PTT	Pull To Ground To Activate
29	Aux In 7	Input	Rx Inhibit	Pull To Ground To Activate
30	Aux In 9 +	Input	Phone Patch - PL Strip	Opto-Isolated In - Current flow to Activate
31	Aux In 10 +	Input	Phone Patch - Monitor	Opto-Isolated In - Current flow to Activate
32	Aux In 11 +	Input		Opto-Isolated In - Current flow to Activate
33	Aux In 12 +	Input		Opto-Isolated In - Current flow to Activate
34	GND		GND	
35	Aux In 14	Input	For future use	Pull To Ground To Activate
36	Aux Out 1	Output	Phone Patch - Inhibit / Enable	Low Impedance to Ground When Active
37	Aux Out 3	Output		Low Impedance to Ground When Active
38	Aux Out 5	Output		Low Impedance to Ground When Active
39	Aux Out Relay 7 N.O.	Output	RD STAT - Receiver Active	Form Relay A Closed When Active
40	Aux Out Relay 8 N.O.	Output	Main Standby - Antenna Relay	Form Relay A Closed When Active
41	Aux Out Relay 9 N.O.	Output		Form Relay A Closed When Active

Table 3-8 50–Pin System Connector Pin-Outs (Conventional) (Continued)

Pin #	Signal	Type	Function	Note
42	Aux Out Relay 10 N.O.	Output		Form Relay A Closed When Active
43	GND		GND	
44	GND		GND	
45	RSTAT	Output	For future use	0 Volts When Inactive / +5 Volts when Active
46	GND		GND	
47	TX DATA +	Input	For future use	Analog Signal
48	GND		GND	
49	PL +	Input	PL(+) In	Analog Signal
50	Gen TX +	Input	Gen TX DATA +	Analog Signal

Figure 3-11 50–Pin System Connector Pin-Out Locations (Conventional)



Wireline Port Pin-Outs

The Wireline port is an RJ-45 connector and can accommodate up to 8 pins.

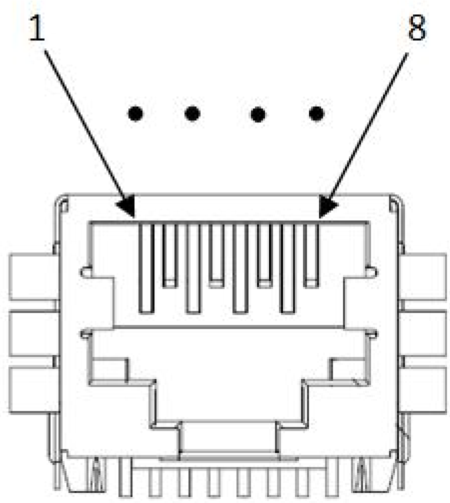
Table 3-9 Wireline Port Pin-Outs

Signal Name	Pin #
Line2_+	1
Line2_–	2
Line3_+	3

Table 3-9 Wireline Port Pin-Outs (Continued)

Signal Name	Pin #
Line1_–	4
Line1_+	5
Line3_–	6
Line4_+	7
Line4_–	8

Figure 3-12 Wireline Port Pin-Out Locations



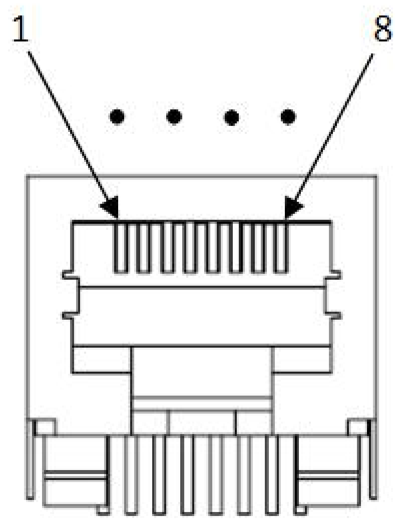
Microphone Port Pin-Outs

The Microphone port is an RJ-45 connector that provides the interface for a microphone.

Table 3-10 Microphone Port Pin-Outs

Signal Name	Pin #
Reserved	1
Reserved	2
MIC_PTT	3
MIC_AUDIO	4
GND	5
Reserved	6
Reserved	7
Reserved	8

Figure 3-13 Microphone Port Pin-Out Locations



Speaker Port Pin-Outs

The Speaker port in an RJ-9 connector that provides the interface to an external speaker.

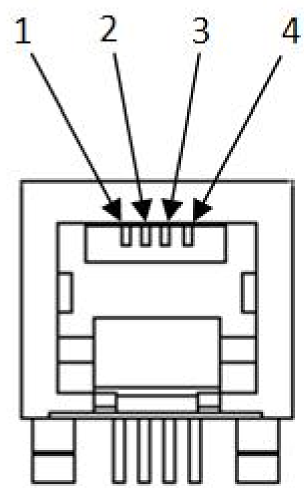
CAUTION

To prevent damage to the base radio, use HSN1006A speaker with 0185180U01 cable.

Table 3-11 Speaker Port Pin-Outs

Signal Name	Pin #
GND	1
+12 V	2
GND	3
Speaker Out	4

Figure 3-14 Speaker Port Pin-Out Locations



V.24 Port Pin-Outs

The V.24 port is an RJ-45 connector that provides the interface to a Digital Interface Unit, Conventional Channel Interface, CCGW, ASTRO-TAC 3000, or Channel Bank.

Table 3-12 V.24 Port Pin-Outs

Signal Name	Pin #	Type
RCLK	1	Input
Rx Line Det	2	Input
TCLK	3	Input/Output
GND	4	GND
Data Rx	5	Input
Data Tx	6	Output
CTS	7	Input
RTS	8	Output

GTR 8000 Base Radio – Part 68 Information

This section applies when the GTR 8000 Base Radio is equipped with the optional wireline interface circuitry contained on the OCXO Transceiver Option Card (Option CA01506AA or TCXO Transceiver Option Card (Option CA01953).

NOTE

The TCXO Transceiver Option Card is used in base radios for the Power Efficiency Package option.

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA. On the rear of this equipment is a label that contains, among other information, the registration number:

- US: ABZNINANT7039

If requested, this number must be provided to the telephone company.

The connector used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. A compliant connector is provided with this product. See installation instructions for details.

REN: N/A
Connector: RJ–48
Authorized Network Port: 04NO2
Service Order Code: 7.0Y

If the equipment causes harm to the telephone network, the telephone company will notify your organization in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify your organization as soon as possible. Also, your organization will be advised of the right to file a complaint with the FCC if it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for your organization to make necessary modifications to maintain uninterrupted service.

If your organization experiences trouble with this equipment, please refer to “Using Motorola System Support Center (SSC)” in the Troubleshooting chapter for repair and warranty information. If the equipment is causing harm to the telephone network, the telephone company may request that your organization disconnect the equipment until the problem is resolved.

None of the circuit boards in this equipment are field repairable. For assistance in sending the boards back for repair, please refer to “Using Motorola System Support Center (SSC)” in the Troubleshooting chapter.

This equipment cannot be used on public coin phone service provided by the telephone company. Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.

Installation/Troubleshooting Tools

In addition to the general tools needed for site installation activities, a service monitor designed specifically for testing the base radio is needed.

To place an order, contact Motorola at:
Phone: 1-800-422-4210 ext. 6883
TTY Phone: 1-866-522-5210
Motorola Online users: Web: http://www.motorola.com/businessonline
Fax: 1-800-622-6210

Quick Connect RF Coaxial Adapters for GTR 8000 Base Radio Support

The GTR 8000 Base Radio employs a number of "QN" & "QMA" Quick Connect RF connectors in its design. The following RF adapters are available from Motorola and can be used to connect test equipment to the various station devices for troubleshooting purposes.

Table 3-13 Quick Connect RF Coaxial Adapters for GTR 8000 Base Radio Support

Type	Adapter / Connector description	Motorola Part Number
"N"/QN	Female "N" to Male QN	5886055Y01
"N"/QN	Female "N" to Female QN	5886055Y10
"N"/QN	Male "N" to Male "QN"	5886055Y05
QN	Right Angle Male QN cable plug for RG-400 coax	2871002H01
QN	Right Angle Male QN cable plug for RG-213 coax	2886067Y01
N/QMA	Female "N" to Male QMA	5886055Y06
N/QMA	Female "N" to Female QMA	5886055Y07
QMA/QMA	Female QMA to Female QMA	5886055Y08
QMA/QMA	Male QMA to Male QMA	5886055Y09
7/16/QN	Female 7/16 to male QN	5886055Y03
7/16/QN	Male 7/16 to Male QN	5886055Y02
7/16/QN	"Female 7/16 to female QN Intermod test adaptor"	5886055Y04
7/16/QN	"Male 7/16 to female QN Intermod test adaptor"	5886055Y11

GTR 8000 Base Radio Software Installation Prerequisites

The installation information in this chapter is based on the ASTRO® 25 system being installed and operational.

Process 3-2 provides a list of items you need to have access to before you can complete the base radio software installation and begin the configuration procedures in the Configuration chapter.

Process 3-2 Prerequisites for Initial GTR 8000 Base Radio Software Installation and Configuration

1	Transfer and install new software to a base radio using Software Download Manager. See "Using Software Download" on page 3-43.
2	Make sure that the ASTRO® 25 system CDs and DVDs are available to you. Specifically, you need the Motorola GTR 8000 Base Radio OS Image CDs to perform "Loading a Device's OS Images to the UNC" on page 3-47.
3	Make sure that you have the user names, passwords and procedures you need to access the devices on the network. For specific user names and passwords to access devices on the network, contact your system administrator. Set up the users in the IT Admin group in Active Directory Users and Computers. Refer to the *Authentication Services* manual.
4	Obtain the following values from the system administrator: • line interface number • ZC site link path 1 IP address • ZC site link path 2 IP address • Host name to access the UNC server application using SSH (<username>@<IP address> format) • Site ID number • IP address 1 and 2 • Primary and secondary NTP IP addresses **NOTE** The following bullets are applicable to systems with AAA Servers, Domain Controllers, or Syslog Servers. • Primary, secondary, and tertiary DNS IP addresses • Requested DNS Domain Name • Requested DNS Host Name • System Name • Primary SYSLOG Service Name (Fully Qualified Domain Name (FQDN) • Backup SYSLOG Service Name (Fully Qualified Domain Name (FQDN)

Process 3-2 Prerequisites for Initial GTR 8000 Base Radio Software Installation and Configuration (Continued)

- RADIUS FQDN parameter value
- RADIUS Row Status parameter value
- RADIUS Service Time Out (sec) parameter value
- RADIUS Service Retransmits Attempts parameter value
- RADIUS Service Dead Timer (min) parameter value
- RADIUS Specific Key parameter value
- RADIUS Service Global Key parameter value

5 Ensure that you have the default credentials (local accounts, central authentication, and SNMPv3) for the device being installed, as well as updated passwords for those types of accounts (so that you can change the password once you install the device). Contact your system administrator, if you do not have this information. Refer to the *SNMPv3* manual for more information.

6 Ensure that the device is configured as a Remote Authentication Dial-In User Service (RADIUS) client on the RADIUS server. When these devices are configured with a RADIUS key that matches a shared secret for that device in Microsoft® Windows® Internet Authentication Service (IAS), they become RADIUS clients. They do not join the Active Directory domain. See the *Authentication Services* manual for more information

7

NOTE

This step is applicable to systems with AAA Servers, Domain Controllers, or Syslog Servers.

To use the VoyenceControl component of Motorola's centralized configuration application for any of the remote site device procedures, you need to set up the Unified Network Configurator (UNC). Depending on your organization's policies, you may also need to implement a secure protocol between the UNC and the remote site device. Before performing any procedures using VoyenceControl, the base radio in the procedures need to be discovered in VoyenceControl and their configurations need to be recently pulled to the Unified Network Configurator's database. See the following ASTRO® 25 system documentation:

- *Unified Network Configurator* manual
- *Securing Protocols with SSH* manual

Using Software Download

The Software Download (SWDL) is an application that can **transfer only**, **install only**, or **transfer and install** new software to devices. The new software can be installed either locally at a site or on the Network Management subsystem. Individual devices not connected to the system can be downloaded using single device mode.

Data transfer can be performed by:

- Clear SWDL – transfer operations without security, based on the File-Transfer Protocol (FTP)
- Secure SWDL – transfer operations are encrypted, based on the Secure File-Transfer Protocol (SFTP)

NOTE

SWDL provisions the credentials for Secure SWDL as part of initiating the SWDL operation. No user intervention is required. For a single device, Secure or Clear SWDL is configured by the user based on the SWDL transfer mode configuration within the CSS. Unified Network Configurator (UNC) can be used to schedule and configure all devices in the system at once.

IMPORTANT

Before initiating transfer, SWDL connects to the site in the zone discover all devices. The transfer mode of all devices is displayed in the SWDL window. It is important that all devices have the same SWDL transfer mode. Otherwise, the SWDL flags a mismatch of the SWDL transfer modes across site devices.

For information on how to configure the secure or clear SWDL transfer mode, see the *Unified Network Configurator* manual and "Device Security Configuration" in the *CSS Online Help*.

Software download can be accomplished in two ways:

- **Centralized Software Download** is a Network Management application that allows you to transfer and install application software from a centralized location. The software download application resides on the Network Management Client PC and a PC loaded with the Configuration Service Software (CSS) application. From either of the PCs, you can select device types to which to download software. Centralized Software Download allows you to select the zone, site, device types, and software download operation to perform.
- **Single Device Software Download** allows you to transfer and install software to a single instance of a device (such as one base radio) that has been disconnected from the radio network. This feature gives self-maintained organizations the ability to install different versions of software. Your organization can also test alignment and field-replaceable units (FRUs) on a device that is not a part of the radio network. Single device software download is done from a PC loaded with the CSS application.

NOTE

Conventional devices are supported only in the single device mode.

SWDL transfers and installs software only to the device through a direct connection to the device's Ethernet service port. When SWDL is connected from a central remote location, SWDL performs a centralized software download to the site controllers then to the base radios installed at the site. Both active and standby site controller modules have two memory banks for loading and running software. One bank is active while the other bank is inactive. The transfer of the software using SWDL is a background process that loads the software into the inactive bank. The site controller executes the software in one bank, while software is simultaneously downloaded to the inactive bank. This is done in the background without interruption of services at the site. An install causes the site controller to reset and activates the bank to run with the new software.

NOTE

- When performing a centralized software download, the site controller coordinates the software transfer and installs the software to all base radios installed at the site.
- A centralized software download can only be performed on a trunked system.

SWDL communicates with the site controller to determine the number of existing channels (base radios). SWDL considers a channel to be accessible if its status is “Not Unconfigured.” This means that the site must be set up with a PC with CSS or a network management client before software download is performed on the site.

When you download the software, the system downloads to the site controllers and base radios as a unit. Use SWDL to transfer software to each device type, then perform an install operation. During the transfer, the operation designates a proxy for each device type at each LAN. Site controllers proxy for base radios. The proxy cross-transfers the software to other devices on the LAN. Using proxies minimizes system downtime. Transfers to the LAN are done simultaneously.

Base radio software installation is done on a channel by channel basis, starting with the highest number channel. When a channel software download occurs, the device which incorporates that channel is processed.

SWDL operation can be fault managed through UEM, syslog, local SWDL log files, user messages, and device reports.

For further information on SWDL, see the *Software Download* manual.

NOTE

The UNC is capable of single device software downloads (ruthless download) to the base radios at a site. See Process 3-3, "Installing the Device using the UNC," on page 3-45.

Device Installation using the UNC

NOTE

UNC is not applicable for K1/K2, Analog Only, or ASTRO 3.1 Conventional systems.

The Unified Network Configurator (UNC) is the Network Manager used to discover a device and load Operating System images. Process 3-3 lists the basic steps involved using the UNC on the device.

Process 3-3 Installing the Device using the UNC

1	Discover the device in the UNC. See Procedure 3-4, "How to Discover a Device in the UNC," on page 3-46.
2	Logging in to the UNC Server Application Using PuTTY. See the *Securing Protocols with SSH* manual.
3	Load the Operating System images to the UNC. See Procedure 3-5, "How to Load the Device OS Images to the UNC," on page 3-47.
4	Enable FTP services on the UNC. See Procedure 3-6, "How to Enable FTP Service," on page 3-48.
5	Transfer and install the OS image to the device. See Procedure 3-7, "How to Transfer and Install the OS Image," on page 3-48.
6	Inspect the device properties for the transferred and installed software. See Procedure 3-8, "How to Inspect Device Properties for Transferred and Installed Software," on page 3-52.
7	Disable FTP services for the UNC. See Procedure 3-9, "How to Disable FTP Service," on page 3-52.

Discovering a Device with the UNC

NOTE

UNC is not applicable for K1/K2, Analog Only, or ASTRO 3.1 Conventional systems.

The discovery process allows site devices to be managed by the Unified Network Configurator (UNC). Once the devices are installed, configured through the CSS, and security parameters are enabled, use Procedure 3-4 to discover the device and then you can update configuration information using this configuration management application.

The UNC network management solution consists of two applications, and both the UNC Wizard and the VoyenceControl applications are used in this procedure.

Once the device is discovered in the UNC, the OS images and base radio CSS configuration files can be loaded to add a base radio to a site, which then connects the site to the current ASTRO® 25 zone core.

Procedure 3-4 How to Discover a Device in the UNC

1	Ensure that DNS is functional on your system. DNS is supplied by a specific server application, which also needs to be operational before you can discover a device.
2	Log on to the UNC Wizard from the NM client, by double-clicking the **Internet Explorer** icon on the desktop. **Result:** The Internet Explorer browser opens.
3	Type **http://ucs-unc0<Y>.ucs:9080/UNCW** in the Address field. Press **Enter**. **NOTE** ucs-unc0<Y>.ucs, where <Y> is the number of the UNC server (01 for primary core UNC server, and 02 for backup core UNC server). **Result:** The UNC Wizard launches and a login dialog box appears.
4	Type the administrative username and password. Click **OK**. **Result:** The UNC Wizard appears.
5	From the list of available wizards on the left side, select **Subnet Discovery**. **Result:** The right side of the window is updated with the Subnet Discovery form.
6	Select **RF Site** by clicking on the Discovery Type drop-down list.
7	Enter the **Zone ID**, **Site ID**, and then click **Submit**. **Result:** An auto-discovery job is created in the UNC Schedule Manager. You are finished using the UNC Wizard at this point.
8	Log on to the UNC from the NM client, by typing **http://ucs-unc0<Y>.ucs**. Press **Enter**. **NOTE** ucs-unc0<Y>.ucs, where <Y> is the number of the UNC server (01 for primary core UNC server, and 02 for backup core UNC server). **Result:** The UNC client launches and a login dialog box appears.
9	Type the administrative username and password. Click **OK**. **Result:** VoyenceControl launches.
10	Press **F7** (Schedule Manager). **Result:** The Schedule Manager window appears in the UNC with the discovery jobs.
11	Verify that the **Zone** and **Site** containers include base radio device(s) just discovered. **NOTE** No sites should be in the Lost and Found folder. If there are, refer to the *Unified Network Configurator* manual for troubleshooting guidance.
12	In the UNC Wizard, select **RF Site Level Configuration**, **Channel** to verify the base radio device(s). Choose **Zone**, if multiple zones exist. **Result:** The device sites are listed, which means they are available for channel configuration.

Loading a Device's OS Images to the UNC

NOTE

UNC is not applicable for K1/K2, Analog Only, or ASTRO 3.1 Conventional systems.

Procedure 3-5 loads the Operating System (OS) images for the devices for distribution through the Unified Network Configurator (UNC). This procedure requires the Motorola device OS Image CDs.

Once OS images are distributed to the UNC, you can update the devices's configuration files to the UNC.

NOTE

The Transport OS Image media is packaged with the Network Management DVDs when an ASTRO® 25 system ships.

Procedure 3-5 How to Load the Device OS Images to the UNC

1	Launch an SSH terminal server session in PuTTY to access the UNC Server Administration menu. See the *Securing Protocols with SSH* manual. **Result:** The UNC Server Administration menu appears.
2	Select **OS Images Administration** from the menu. Press **Enter**. **Result:** The OS Images Administration menu appears.
3	Select **Load new OS images** from the menu. Press **Enter**. **Result:** A message appears indicating there are two methods for loading OS Images.
4	Insert the **Motorola OS Images** CD into the CD/DVD-ROM drive of the server. **Result:** The drive light starts blinking on the server.
5	When the drive light stops blinking, press **Enter**. **Result:** The OS images load on the UNC.
6	Select **View OS Images** from the menu. Press **Enter**. **Result:** The device software image appears.
7	Select **Eject CD** from the menu. Press **Enter**. **Result:** The media ejects from the drive on server.
8	Remove the OS Image CD from the CD/DVD-ROM drive of the server.
9	To log out of the server, press **Enter**. **Result:** The User Configuration Server Administration menu appears.
10	Press **Enter** again. **Result:** The prompt appears.

Loading OS Software to a Device

NOTE

UNC is not applicable for K1/K2, Analog Only, or ASTRO 3.1 Conventional systems.

These procedures describe how to load software images onto UNC and download and install this software to the device. However, before you begin to install the software, you must enable FTP as described in Procedure 3-6.

Procedure 3-6 How to Enable FTP Service

1	Launch an SSH terminal server session in PuTTY to access the UNC Server Administration menu. See the *Securing Protocols with SSH* manual. **Result:** The UNC Server Administration menu appears.
2	Select **Unix Administration** from the menu. Press **Enter**. **Result:** The Unix Administration menu appears.
3	Select **FTP Services** from the menu. Press **Enter**. **Result:** The FTP Services menu appears.
4	Select **Enable FTP service** from the menu. Press **Enter**. **Result:** The FTP Services are enabled and available for software transfer and install operations.

Procedure 3-7 describes how to download the OS image from the UNC to the device.

Procedure 3-7 How to Transfer and Install the OS Image

1	On the PNM client where you set up VoyenceControl, double-click the UNC shortcut on the desktop. **NOTE** You can also paste the following address into IE web browser: **`http://ucs-unc0<Y>.ucs`** where <Y> is the number of the UNC server (01 for primary core UNC server, and 02 for backup core UNC server). **Result:** Internet Explorer opens to the URL of the application server, and a VoyenceControl client session launches with the welcome page. See Figure 3-15.

Procedure 3-7 How to Transfer and Install the OS Image (Continued)

Figure 3-15 VoyenceControl Welcome Page

2 Click the **launch VoyenceControl**™ link.

Result: VoyenceControl client session launches with the login window.

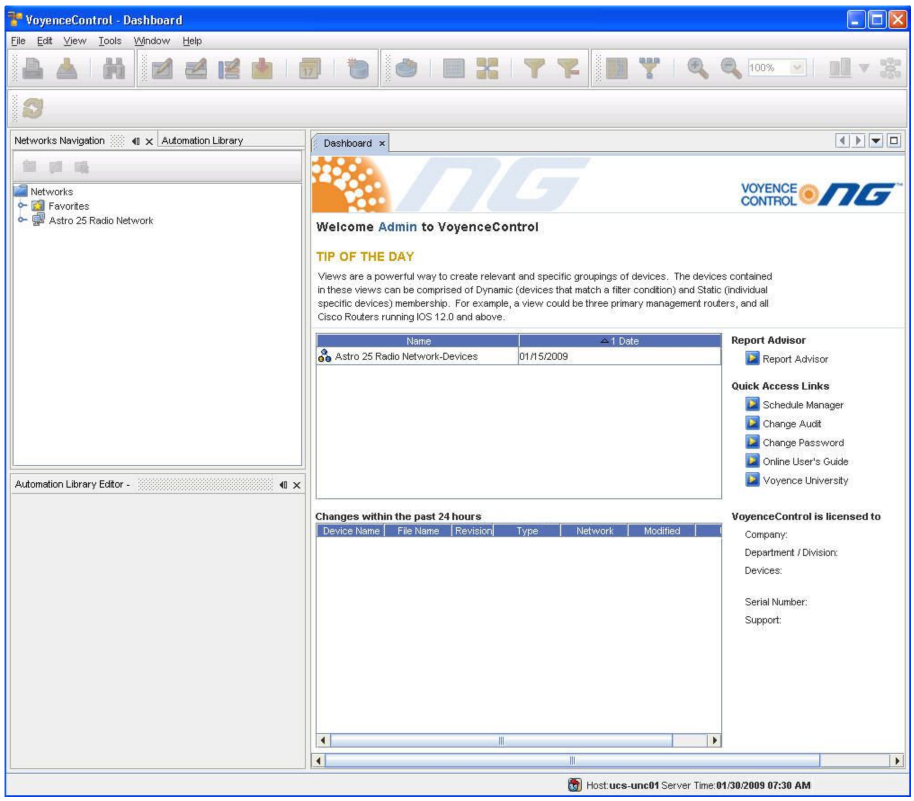
Figure 3-16 VoyenceControl Login Window

3 Enter the User ID and Password. Click **OK**.

Result: The VoyenceControl Dashboard appears.

Procedure 3-7 How to Transfer and Install the OS Image (Continued)

Figure 3-17 VoyenceControl Dashboard



4 In the left navigation pane, expand **Networks**, **ASTRO 25 Radio Network**, then **Views**.

Result: The list of options expands.

5 Double click **Motorola <device>** from the navigation pane.

Result: The view opens and all currently discovered devices appear.

6 Select **Tools**, **OS Inventory**.

NOTE

You can also press the **F9** key to select the OS Inventory.

Result: A list of the OS images appears.

7 Verify OS images loaded on the UNC server appear in the OS inventory.

NOTE

These images were automatically created during the “How to Load OS Images to the UNC” procedure.

8 Under **Networks** in the navigation pane, select one or more devices from the same device class, right click the selections, then choose **Update OS Image** from the menu.

Result: The Select OS Image window appears.

Procedure 3-7 How to Transfer and Install the OS Image (Continued)

9	Select **Software Image** and click **Next**. **Result:** The Update OS Image window appears.
10	Select each device that appears in the Selected Devices section. **Result:** This associates a version to a device instance. **NOTE** In most cases, the “summary of device partitions” are already set up and you just need to verify the values in step 10 to step 13.
11	Select **nvm partition** from the Manage Partition for Device section. **Result:** This defines where the OS image is transferred. **NOTE** This is the only choice for the base radio device.
12	Select the image for this device from the **Selected Image** section. **NOTE** You can ignore the Install and Copy check boxes. **Result:** This populates the Image Info tab and informs the application which image to use.
13	Click **Add**. **Result:** This populates the Summary of Device Partitions for Device and confirms the proper setup.
14	Select the **Device Options** section, **Software Operations** , then choose **transfer**, **install**, or **both**. **Result:** This indicates which operations occur when the job is executed. **NOTE** If you choose transfer, you must select the install option later to complete the installation. If you choose both, the software is transferred and then installed. There are up to two resets of the device during installation.
15	Click **Schedule**. **Result:** The Schedule Push Job window appears.
16	Configure the schedule information and click **Approve and Submit**. **Result:** This approves the job and you can view it in the Schedule Manager window. **NOTE** If you choose Submit, you are asked to approve the job later.
17	Verify the job status by pressing **F7** (Schedule Manager). **Result:** The Schedule Manager window appears in the UNC with the discovery jobs.

Once the software has been transferred and installed, use Procedure 3-8 to inspect the device properties before assuming the installation was a success and disabling FTP service.

Procedure 3-8 How to Inspect Device Properties for Transferred and Installed Software

1	From the **Device** view, right click the device, select **Pull**, then **Pull Hardware Spec**. **Result:** The current software version information is updated in the UNC. **NOTE** You can skip this step if a Pull All or Pull Hardware Spec has already occurred.
2	From the **Device** view, right click on the device, then choose **Properties**. **Result:** The Device Properties window appears. **NOTE** If you select the Properties icon, you can view the device properties directly within the Device view.
3	Choose the **Configuration** tab, then the **Hardware** tab.
4	Double click the **Chassis** object from the **Physical Hardware** properties. **Result:** The Chassis property tree expands.
5	View the following properties and their values: • **Bnk1:<device>**: Transferred software in bank 1. • **Bnk2:<device>**: Transferred software in bank 2. • **<device>**: Installed and Running Software. **NOTE** You can use the Table format (instead of the Diagram format) to view the Installed and Running Software in the Device view.

After the transfer and installation of the software, the FTP service must be disabled. Follow Procedure 3-9 to disable FTP service.

Procedure 3-9 How to Disable FTP Service

1	Launch an SSH terminal server session in PuTTY to access the UNC Server Administration menu. See the *Securing Protocols with SSH* manual. **Result:** The UNC Server Administration menu appears.
2	Select **Unix Administration** from the menu. Press **Enter**. **Result:** The Unix Administration menu appears.
3	Select **FTP Services** from the menu. Press **Enter**. **Result:** The FTP Services menu appears.

Procedure 3-9 How to Disable FTP Service (Continued)

4	Select **Disable FTP service** from the menu. Press **Enter**. **Result:** The FTP Services are disabled and unavailable for software transfer and install operations.
5	Back out of the menus by pressing **q** three times.
6	At the prompt, type **`exit`** to return to the previous menu.
7	Type **`exit`** again. **Result:** You have successfully logged out of the application.
8	Close the PuTTY connection.

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Chapter

4

GTR 8000 Base Radio Configuration

Proper software/hardware configuration for the GTR 8000 Base Radios and subsystems require the following activities:

- Updating factory-installed base radio application software
- Setting parameters in a configuration file stored on the GTR 8000 Base Radio that impacts both base radio and RF Distribution System (RFDS) functionality.

This chapter details configuration procedures relating to the GTR 8000 Base Radio.

Configuration Software

Configuring the GTR 8000 Base Radios requires two software applications to be loaded on the service PC: Configuration/Service Software (CSS) and Unified Network Configurator (UNC).

- **CSS** is used to configure the parameters on the base radios. CSS can access devices remotely over the network, or locally through an Ethernet connection to the service port on the base radio or receiver. CSS also can be used to view status information, equalize batteries, and check internal logs of the equipment at the site. See the *CSS Online Help* for configuration details.
- **UNC Wizard** is a component of UNC and is used to configure the parameters of a site, subsite, and channel. See the *UNC Wizard Online Help* for configuration details.
- **VoyenceControl** is a component of UNC and can be used to pull and push configurations and configure the parameters of the device. See the *Unified Network Configurator* manual for general information about using VoyenceControl functions.

NOTE

While it is possible to configure a conventional device using UNC, it is preferable to use CSS since configuration dependencies are only enforced by the CSS.

All parameters are programmed locally when the site is installed but not linked to a network. All parameters should be tested prior to making the site available. The ability to program locally provides the means to test the site prior to making it available for system operation.

Discovering Devices in the UNC

Process 4-1 describes the high-level steps to discover the devices in the UNC. Refer to the *Unified Network Configurator* manual for details on discovering devices.

Process 4-1 Discovering Devices in the UNC

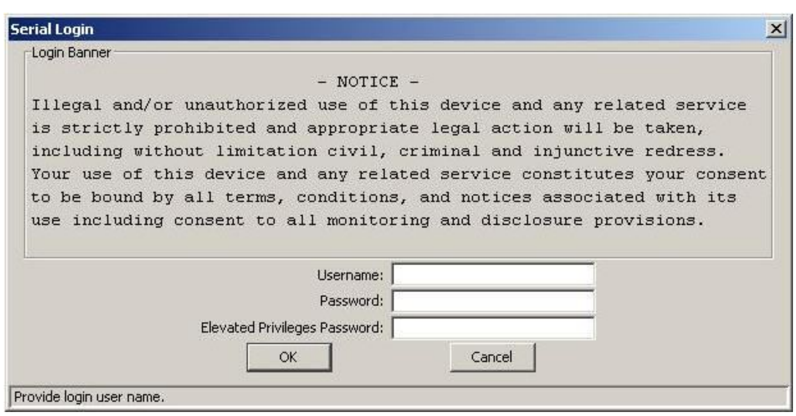
1	Use the Unified Network Configurator Discovery Wizard to: • Discover the devices. • Upload configurations for the devices. • Generate changes for non-compliant devices.
2	Approve jobs (if any).

Security/Authentication Services

Figure 4-1 SNMPv3 Security Level Option Prompt

If the device supports SNMPv3 protocol, a pop-up window appears displaying the SNMPv3 Password Prompt when logging into a device through Configuration/Service Software (CSS) using an Ethernet connection. Enter your Authentication Passphrase and Encryption Passphrase if the chosen security level requires inserting these credentials. If Authentication Services are not enabled on a device, click **OK** when the pop up window appears. For configuration details, see the *Information Assurance Features Overview*, *Software Download*, and *SNMPv3* manuals. See Figure 4-1.

Figure 4-2 CSS Login Banner



A pop-up window appears displaying the File Transfer Access Services for Configuration/Service Software (CSS). This logon is used when communicating to a device through CSS using either an Ethernet or DB-9 Serial Port connection. If Authentication Services are enabled on a device, enter your Username, Password, and Elevated Privileges Password, if the chosen security level requires inserting these credentials. If Authentication Services are not enabled on a device, type anything to populate the [Username, Password, and Elevated Privileges Password] fields, as they cannot be left blank. See Figure 4-2.

Configuring a Device Using CSS

This section covers configuration of a device using the Configuration/Service Software (CSS).

NOTE

If you do not know the IP address for the device, it is available through a serial port connection in the **Tools**, **Set IP Address** from the menu.

Initial Configuration of a Device Using CSS

Follow Process 4-2 to initially configure a device using CSS.

Process 4-2 Initially Configuring a Device Using CSS

1	Perform the following configuration steps that require a serial connection. See Procedure 4-1, "How to Connect Through a Serial Port Link," on page 4-5. **1.** Set the IP address of the device. See Procedure 4-2, "How to Set a Devices IP Address in CSS," on page 4-7. **2.** Set the serial security services. See Procedure 4-3, "How to Set the Serial Security Services Using CSS," on page 4-9.
2	Perform the following configuration steps that require an Ethernet connection. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10 **1.** Set the current date and time in CSS. See Procedure 4-5, "How to Set the Date and Time Using CSS," on page 4-13. **2.** Change the SNMPv3 configuration and user credentials from CSS on a selected device in the site. See Procedure 4-6, "How to Change SNMPv3 Configuration and User Credentials Using CSS," on page 4-13. **3.** Create, update, or delete an SNMPv3 user. See Procedure 4-7, "How to Add or Modify an SNMPv3 User Using CSS," on page 4-16. **4.** Verify the SNMPv3 credentials. See Procedure 4-8, "How to Verify SNMPv3 Credentials Using CSS," on page 4-17. **5.** Configure DNS for a conventional base radio using the CSS. See Procedure 4-9, "How to Configure DNS Using CSS," on page 4-19 **6.** Set the SWDL transfer mode. See Procedure 4-11, "How to Set the SWDL Transfer Mode Using CSS," on page 4-21. **7.** Configure for SSH. See Chapter 4, “Configuring SSH for RF Site Devices and VPMs Using CSS” in the *Securing Protocols with SSH* manual. **8.** Enable RADIUS Authentication using the CSS. See Chapter 7, “Configuring RADIUS Sources and Parameters Using CSS” in the *Authentication Services* manual. Make sure that the base radios have been added to the RADIUS servers on the domain controllers as RADIUS clients.

Process 4-2 Initially Configuring a Device Using CSS (Continued)

	9. Enable Centralized Authentication using the CSS. See Chapter 7, “Enabling/Disabling Centralized Authentication Using CSS” in the *Authentication Services* manual. **10.** Set the Local Cache Size for Centralized Authentication using the CSS. See Chapter 7, “Setting the Local Cache Size for Central Authentication Using CSS” in the *Authentication Services* manual. **11.** Customize the login banner text using CSS (optional). See Procedure 4-10, "How to Customize the Login Banner Using CSS," on page 4-21. **12.** Enable Centralized Event Logging using the CSS (optional). See Chapter 6, “Enabling/Disabling Centralized Event Logging on Devices Using CSS” in the *Centralized Event Logging* manual. **13.** Set the NTP Server Settings. See "Setting the NTP Server Settings".
3	Set up the local Password Configuration using the CSS (optional). See Procedure 4-12, "How to Set the Local Password Configuration Using CSS," on page 4-23.
4	Continue to one of the following depending on the type of device you are configuring: • Process 4-3, "How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for Trunked Simulcast," on page 4-24 • Process 4-4, "How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for Trunked Repeater," on page 4-25. • Process 4-5, "How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for HPD," on page 4-27. • Process 4-6, "How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for Conventional," on page 4-28.

Connecting Through a Serial Port Link

This procedure assumes CSS is loaded on your computer. Refer to the *Private Network Management Client* manual if necessary.

Procedure 4-1 describes the steps required to perform a serial connection.

Procedure 4-1 How to Connect Through a Serial Port Link

1	Connect a serial cable to a laptop or PC running the CSS application, and the serial connector located on the device's module. The serial cable is an **RS232** cable. This is a DB-9 straight through serial cable (**female DB-9 to male DB-9**). If the laptop does not have a serial port, use a USB to serial converter external device.
2	Open the CSS application.

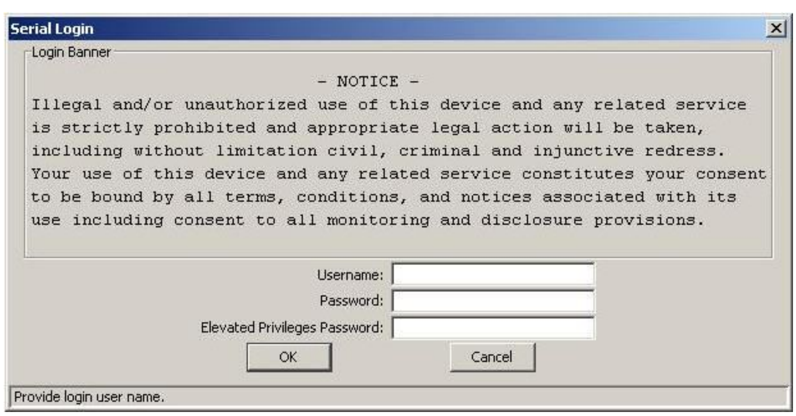
Procedure 4-1 How to Connect Through a Serial Port Link (Continued)

3	Do one of the following: • Select **Connection Configuration** from the **Tools** menu. • Click on the **Connect to Device** icon on the toolbar. **Result:** The Connection Screen dialog box appears.
4	Select **Serial** on the Connection Type field. **Result:** The Serial Settings on the dialog box become enabled.
5	Select the communication port in the Serial Port field that matches the one selected on the PC.
6	In the Baud Rate field, select the baud rate with which you want to communicate with the device. • Baud Rate 19200
7	Click **Connect**.

NOTE

A login/password prompt screen opens. Provide the required credentials as follows. Click **OK**. When accessing the device, if the default passwords do not work, the passwords may have been set to default values by a different system release of software. Refer to the *CSS Online Help's* "Resetting Device Passwords" screen to reset the passwords to the current software release defaults. If Authentication Services are not enabled on a device, type anything to populate the [Username, Password, and Elevated Privileges Password] fields, as they cannot be left blank.

Figure 4-3 CSS Login Banner



IF...	THEN...
If a domain controller is available on the network...	Type the Username and Password for your RADIUS service user account that is assigned to the netwadm group in Active Directory. (The default user is serviceuser.)
If a domain controller is not available on the network...	Type the Username and Password for the local bts_service account.

Procedure 4-1 How to Connect Through a Serial Port Link (Continued)

	If the Elevated Privileges Password field is active...	Type the Elevated Privileges Password that was set up for this device.
	NOTE See Procedure 4-3, "How to Set the Serial Security Services Using CSS," on page 4-9 to configure Authentication Services on the device.	
8	Click **OK** to close the dialog box. **Result:** The blank CSS main window appears. **NOTE** The **Service** menu is not available until you read the configuration file from the device using an Ethernet connection.	

Serial Connection Configuration

The following procedures are configuration parameters in the CSS using a serial connection.

Setting the Device's IP Address Using CSS

Procedure 4-2 describes how to set the IP Address of a selected device in the site.

NOTE

Setting or changing the device's IP Address causes the SNMPv3 configuration and user credentials to automatically reset.

Procedure 4-2 How to Set a Devices IP Address in CSS

1	**IMPORTANT** Ensure that you have the required credentials information (local service account password and elevated privileges password) to configure the site devices before proceeding. The user credentials information includes both the current and new credentials. Without the current credentials, you cannot access the device and cannot change the user credentials. See Chapter 8, "Resetting Passwords and SNMPv3 Passphrases".

Procedure 4-2 How to Set a Devices IP Address in CSS (Continued)

	Connect to the device using Configuration/Service Software (CSS) through a serial port link. See Procedure 4-1, "How to Connect Through a Serial Port Link," on page 4-5.
2	Select **Tools**, **Set IP Address/BR_CM Pairing Number** from the menu. **Result:** The Set IP Address and BR_CM Pairing Number dialog box appears. **NOTE** If the device is not in a voting or simulcast IP only topology, the menu item will read as **Set IP Address/Box Number**.
3	Enter the device's IP address in the **Device IP Address** field and click **Set Device IP Address**.
4	In a voting or simulcast IP only topology, enter the device's pairing number and click **Set BR/CM Pairing Number**.
5	Click **OK** to close the dialog box.
6	Click **Reset** to initiate a hardware restart. **Result:** SNMPv3 user credentials reset to their factory default values.
7	Click **Close** to close the dialog box.
8	Proceed to Procedure 4-6, "How to Change SNMPv3 Configuration and User Credentials Using CSS," on page 4-13 to reconfigure the SNMPv3 user credentials.

Pairing To a Comparator

When operating in a voting, multicast, or IP simulcast configuration, base radios and receivers must be paired to comparators using the BR_CM Pairing Number. The BR_CM Pairing Number for both the base radio/receiver and comparator is used to create an IP multicast group that allows the base radio/receiver and comparator to talk to each other. The base radio/receiver listens for messages that the comparator sends in order to establish an IP connection with all the paired base radios/receivers. When the base radio/receiver receives the message from the comparator, it extracts the comparator's IP address from the message and uses it to send received voice and data back to the comparator.

Communication from the comparator to the paired base radios/receivers always uses a multicast IP address. Communication between the paired base radios/receivers to the comparator always uses a unicast IP address.

The multicast IP address is calculated based on the channel number and the formula as follows:

224.10.100.nnn, where nnn is: (2 * channel number) - 1 for channel number between [1, 127]
224.10.101.nnn, where nnn is: (2 * (channel number – 127) - 1) for channel number between [128, 200]

NOTE

The Pairing Number is not used for circuit (V.24 or 4–wire/V.24 hybrid link) configurations.

See Procedure 4-2, "How to Set a Devices IP Address in CSS," on page 4-7 on how to set the Pairing Number.

Setting the Serial Security Services Using CSS

Procedure 4-3 describes how to enable the secure services and change the device password. Perform these steps before changing the SNMPv3 configuration and user credentials from CSS on a selected device in the site.

Prior to enabling this parameter, any login and password may be used on the File Transfer Access Services login window to access a device. After Authentication Services are enabled, the login and password provided will be checked against the following authentication sources:

- **Stored password**—RF site devices support a configurable password for the Local Service and Elevated Privileges accounts. The password is verified against the stored password for these accounts.
- **Built-in logins and passwords**—RF site devices support built-in login/password combinations for login by services such as Software Downloads (SWDL). Only certain SWDL login names are authenticated in this way.
- **Centralized Authentication**—For authentication through centralized accounts instead of Local Service, Elevated Privileges, and built-in user accounts, you need to configure the Centralized Authentication parameter in CSS for the CHAP protocol. See Chapter 7 "Enabling/Disabling Centralized Authentication Using CSS" in the *Authentication Services* manual. Note that this procedure requires an Ethernet connection to the device being configured.

Procedure 4-3 How to Set the Serial Security Services Using CSS

1	IMPORTANT Ensure that you have the required credentials information (local service account password and elevated privileges password) to configure the site devices before proceeding. The user credentials information includes both the current and new credentials. Without the current credentials, you cannot access the device and cannot change the user credentials. See Chapter 8, "Resetting Passwords and SNMPv3 Passphrases". Changing to the incorrect user credentials may lead to not being able to access the device through CSS or SSH. Connect to the device using Configuration/Service Software (CSS) through a serial port link. See Procedure 4-1, "How to Connect Through a Serial Port Link," on page 4-5.
2	Select **Security**, **Device Security Configuration**, **Security Services (Serial)** from the menu. **Result:** The Security Services Configuration dialog box opens.
3	Set the **Test Application Configuration** field according to your organization's policies. The recommended secure configuration is **Disabled**.
4	Set the **Authentication Services** field to **Enabled**. This field enables local authentication services and must be enabled as a prerequisite for centralized authentication.
5	Set the **Password Reset Mechanism** field. This field allows a user to reset the passwords for two built-in device accounts to their default values.

Procedure 4-3 How to Set the Serial Security Services Using CSS (Continued)

6	To update the password for the device, select either **Service Account** or **Elevated Privilege** from the drop-down list and click **Update password**. **Result:** A Change Account Password dialog box opens.
7	Enter the old password, then enter a new password and confirm the new password before clicking the **Change Password** button.
8	Click **OK** to save the new password. **Result:** The Change Account Password dialog box closes.

Connecting Through an Ethernet Port Link

Procedure 4-4 explains how to connect the device through an Ethernet connection. This procedure assumes CSS is loaded on your computer. Refer to the *Private Network Management Client* manual if necessary or see the instructions in the CSS CD-ROM jewel box for instructions on loading the CSS on the laptop or computer.

The 10/100Base-T LAN is not the default Ethernet port setting for the base radio. To set the correct port speed and duplex, refer to the CSS.

NOTE

If you do not know the IP address for the device, it is available through a serial port connection in the **Tools**, **Set IP Address** from the menu.

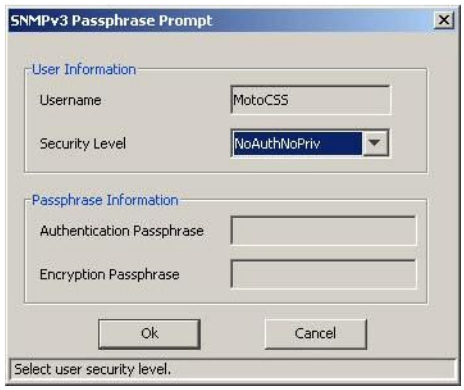
Procedure 4-4 How to Connect Through an Ethernet Port Link

1	Connect an Ethernet straight through cable between the Ethernet port on a computer (either laptop or desktop) and the appropriate LAN switch either locally or remotely through the network. The IP address of the computer must be set to the 192.168.1.x subnet (where x is any number between 2 to 253). Configure the Speed/Duplex setting of the PC's Ethernet interface to 10 Mb Half Duplex. **NOTE** Normally you connect the computer to the appropriate LAN switch. You do not connect directly to the Ethernet service port of the device unless you are downloading the software individually to that device.
2	Open the CSS application.
3	Select **Connection Configuration** from the **Tools** menu, or click the **Connect to Device** button on the toolbar. **Result:** The Connection Screen appears.
4	Verify that **Ethernet** is selected in the **Connection Type** area.
5	If connected through the LAN switch, specify the IP address for the device in the Ethernet Settings area. Do the following: **IF you...** **THEN...**

Procedure 4-4 How to Connect Through an Ethernet Port Link (Continued)

	Know the IP address for the device.	**1.** Enter the IP address for the device in the **Device IP Address** field. **2.** Continue with step 7.
	Trunked device: Do not know the IP address, but know the system identification of the device (the zone, site, subsite, and device ID of the device)	**1.** Click **Fetch DNS Entry**. **Result:** The DNS IP Address Calculation Screen dialog box appears. **2.** Select the desired device type from the Device list box. **3.** Enter the proper values in the Zone, Site, Subsite, and Device ID fields. **NOTE** Some fields, such as Subsite, do not allow entries for some devices. Therefore, select the device first. **4.** Click **OK**. **Result:** The **DNS information** of the device automatically appears in the **Device IP Address** field. **5.** Continue with step 7.
	Conventional device: Do not know the IP address	**1.** Establish a serial connection to the device. See Procedure 4-1, "How to Connect Through a Serial Port Link," on page 4-5. **2.** Select **Set IP Address/BR_CM Pairing Number** from the Tools menu. **3.** Read the IP address from the **Device IP Address** field. **4.** Re-establish an Ethernet connection and repeat steps 1 through 4. **5.** Enter the IP address for the device in the **Device IP Address** field. **6.** Continue with step 7.
6	If connected directly to the Ethernet service port of the device, click **Front Panel Ethernet**.	

Procedure 4-4 How to Connect Through an Ethernet Port Link (Continued)

7	**1.** To make the connection, click **Connect**. **Result:** A Passphrase Prompt screen opens. **Figure 4-4** SNMPv3 Security Level Option Prompt  **2.** Enter User Information and Passphrase Information. Click **OK**. If Authentication Services are not enabled on a device, click **OK** when the window appears. **NOTE** See "Changing SNMPv3 Configuration and User Credentials Using CSS" on page 4-13 to configure or change SNMPv3 configuration and user credentials on the device.
8	Select **Read Configuration From Device** from the **File** menu. You can also click the **Read Configuration to Device** button. **Result:** The parameters download from the device to the computer. When the download is complete, the CSS Main window opens. You can use the map on the left side of the screen to view configuration information for the device.

Ethernet Connection Configuration

The following procedures are configuration parameters in the CSS using an Ethernet connection.

Setting the Date and Time Using CSS

Procedure 4-5 provides the date and time to the device. In the event of a power outage, the device does not retain the date and time settings.

NOTE

During installation this is done through an Ethernet cable connected directly to the Ethernet port of the device. After installation this procedure may be performed from a remote CSS.

Procedure 4-5 How to Set the Date and Time Using CSS

1	Connect to the device using Configuration/Service Software (CSS) through an Ethernet port link. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10.
2	Choose **Tools**, then **Set Device Date and Time** from the menu.
3	Enter the current date and time, then choose **OK**. **Result:** The date and time is set.

Changing SNMPv3 Configuration and User Credentials Using CSS

Procedure 4-6 changes the SNMPv3 configuration and user credentials from CSS on a selected device in the site. For more information on this feature, refer to the *SNMPv3* manual.

NOTE

During installation this is done through an Ethernet cable connected directly to the Ethernet port of the device. After installation this procedure may be performed from a remote CSS.

Procedure 4-6 How to Change SNMPv3 Configuration and User Credentials Using CSS

1	**IMPORTANT** Ensure that you have the required SNMPv3 credentials information (Authentication passphrase, Encryption passphrase, and Authoritative Engine ID) to configure the device before proceeding. The user credentials information includes both the current and new credentials. Without the current credentials, you cannot access the device and cannot change the user credentials. See Chapter 8, “Resetting Passwords and SNMPv3 Passphrases”. Changing to the incorrect user credentials may lead to not being able to access the device from the UNC or for the device to not be able to send alarms to the Unified Event Manager (for fault management).

Procedure 4-6 How to Change SNMPv3 Configuration and User Credentials Using CSS (Continued)

	Connect to the device using Configuration/Service Software (CSS) through an Ethernet port link. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10.
2	Choose **Security**, **SNMPv3 Configuration**, then **Configure SNMPv3 Users (Ethernet)**. **Result:** The SNMPv3 Passphrase dialog box appears with MotoAdmin as the selected SNMPv3 user.
3	Enter the appropriate Authentication and Encryption Passphrases in the fields. **NOTE** When accessing the device for the first time, if the default passphrases do not work, the passphrases may have been set to default values by a different system release of software. Refer to the *CSS Online Help's* "Reset SNMPv3 Configuration (Serial)" screen to reset the passphrases to the current software release defaults
4	Enter the Device IP address field. Do the following:

IF you...	THEN...
Know the IP address for the device.	**1.** Enter the IP address for the device in the **Device IP Address** field. **2.** Continue with step 5.
Do not know the IP address, but know the system identification of the device (the zone, site, subsite, and device ID of the device)	**1.** Click **Fetch DNS Entry**. **Result:** The DNS IP Address Calculation Screen dialog box appears. **2.** Select the desired device type from the Device list box. **3.** Enter the proper values in the Zone, Site, Subsite, and Device ID fields. **NOTE** Some fields, such as Subsite, do not allow entries for some devices. Therefore, select the device first. **4.** Click **OK**. **Result:** The **DNS information** of the device automatically appears in the **Device IP Address** field. **5.** Continue with step 5.

5	Click **OK**. **Result:** A connection is made with the selected device, and the entered SNMPv3 admin passphrases are authenticated and the Configure SNMPv3 Users dialog box appears. If the connection fails, a message appears.

Procedure 4-6 How to Change SNMPv3 Configuration and User Credentials Using CSS (Continued)

6 To choose the SNMPv3 user whose credentials are to be updated, select **Username** from the Username list in the User Information form of the Configure SNMPv3 Users dialog box.

Result: The CSS retrieves the current credentials from the device for the selected user.

NOTE

Depending on the user selected, some fields on this dialog box become Read-Only or disabled. Click **Cancel** on the Configure SNMPv3 Users dialog box at any time to discard changes made to the selected user.

7 To change or update the SNMPv3 security level for the selected user, select the security level from the Security Level list in the User Information form of the Configure SNMPv3 Users dialog box. The security level options are:

- **NoAuthNoPriv**: Neither the Authentication Passphrase nor Encryption Passphrase is needed for communicating with the device.
- **AuthNoPriv**: Authentication Passphrase is needed; but no Encryption Passphrase is needed for communicating with the device.
- **AuthPriv**: Both Authentication Passphrase and Encryption Passphrase are needed for communicating with the device.

Result: The security level of the selected user is set.

NOTE

The User Status field on the Configure SNMPv3 Users dialog box reflects the current operational status of the selected SNMPv3 User. The Status Types include:

- **Active**: User configured on device; Update and Delete buttons are enabled.
- **Not in service**: User configured on device; Update and Delete buttons are enabled.
- **Not ready**: User configured on device; Update and Delete buttons are enabled.
- **Not present**: Not present on the device; Create button is enabled.

8 To change the Authentication Passphrase for the selected SNMPv3 user (if applicable to the selected security level), type the password into the **Old Passphrase Field** in the Authentication Passphrase form of the Configure SNMPv3 Users dialog box.

NOTE

If you do not know the passphrase, click the **I do not remember old passphrase** check box.

Procedure 4-6 How to Change SNMPv3 Configuration and User Credentials Using CSS (Continued)

9	Type the new passphrase into the **New Passphrase** field. **NOTE** Passphrase must be between 8 and 64 characters in length and passphrase must consist of upper or lowercase alphanumeric characters (excluding the @ # $ ^ or _ characters).
10	Type the same new passphrase into the **Confirm New Passphrase** field.
11	To change the encryption passphrase for the selected SNMPv3 user (if applicable to the selected security level), type the old passphrase into the **Old Passphrase Field** in the Encryption Passphrase form of the Configure SNMPv3 Users dialog box. **NOTE** If you do not know the passphrase, click the **I do not remember old passphrase** check box.
12	Type the new passphrase into the **New Passphrase** field, then type the same new passphrase into the **Confirm New Passphrase** field.
13	To change the Authoritative Engine Identifier (applicable to MotoInformA and MotorInformB users only), select the desired current engine ID from the **Current Engine ID List** in the **Authoritative Engine ID Section** of the Configure SNMPv3 Users dialog box.
14	Type the new engine ID into the **New Engine ID** field. **NOTE** The new engine ID must be between 1 and 27 characters and comply with the Engine ID Domain Name Syntax. **Result:** The authoritative engine ID is assigned.
15	To create, update, or delete SNMPv3 users, continue on with Procedure 4-7.

Adding or Modifying an SNMPv3 User Using CSS

Procedure 4-7 describes how to create, update, or delete an SNMPv3 user from the Configure SNMPv3 Users Screen dialog box.

Procedure 4-7 How to Add or Modify an SNMPv3 User Using CSS

1	In the CSS, log in using the appropriate credentials. **Result:** The Configure SNMPv3 Users dialog box appears.	
2	To create, delete, or update the selected SNMPv3 user, use one of the following steps:	
	IF...	**THEN...**

Procedure 4-7 How to Add or Modify an SNMPv3 User Using CSS (Continued)

	You want to create a user when the status is Not Present	Click the **Create** button.
	You want to update an existing user	Click the **Update** button.
	You want to remove an existing user	Click the **Delete** button.
	Result: A Confirmation dialog box appears and asks if you want to continue.	
3	Click **Yes**. **Result:** The Processing Requests dialog box appears and processes the request. A green square indicates OK and a red square indicates failure.	
4	After reviewing the processing status, click **OK**. NOTE If you encounter any errors, go back to the appropriate step and correct the information entered.	
5	Repeat these steps for any SNMPv3 users you wish to create, update, or delete.	
6	Select the **Cancel** button to exit the Configure SNMPv3 Users dialog box. **Result:** The Configure SNMPv3 Users dialog box closes, and the CSS main window returns.	
7	Choose **File**, **Exit**. Click **OK**. **Result:** The CSS application closes.	

Performing an SNMPv3 Connection Verification Using CSS

Once the SNMPv3 user credentials have been created, modified, or deleted, you can perform a sanity check to ensure the device is properly configured for SNMPv3. Procedure 4-8 describes how to verify the SNMPv3 connection.

Procedure 4-8 How to Verify SNMPv3 Credentials Using CSS

1	Connect to the device using Configuration/Service Software (CSS) through an Ethernet port link. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10.
2	When the passphase prompt screen opens, select configured security level and enter the required passphrases.
3	Click **OK** if the connection was successful. This indicates your SNMPv3 configuration is valid.

Configuring DNS Using CSS

NOTE

This is not applicable for K1/K2, Analog Only, or ASTRO 3.1 Conventional systems.

The Network Services Configuration window allows you to configure the network DNS services for this device, if part of a secure network.

Procedure 4-9 describes the steps for configuring DNS for a device using Configuration/Service Software (CSS). Configuring DNS is required before entering the Fully Qualified Domain Name (FQDN) for server(s) on the RADIUS Service Configuration window in CSS.

Using Table 4-1, enter the IP addresses for the primary, secondary, and tertiary DNS servers for this device, as follows:

Table 4-1 DNS Nameservers for Devices in Dynamic System Resilience and Dynamic System Resilience Sites

To configure on a device:	When device is located in a remote site with no Dynamic System Resilience	When device is located in a Dynamic System Resilience remote site
Primary DNS server	z<zzz>dns01.zone<z>	z<zzz>dns01.zone<z>
Secondary DNS server	ucs-dns01.ucs	z<zzz>dns04.zone<z>
Tertiary DNS server	N/A	ucs-dns01.ucs

where <zzz> and <z> indicate the zone to which the device belongs.

Table 4-2 Conventional Base Radio System Name Variables

Variable	Description
[hostname]	The character string entered in the Requested DNS Host Name field.
chanWWW	The channel number, where WWW is a number between 1 and 200.
siteXXXX	The logical Site ID (as configured on the Site configuration screen), where XXXX is a number between 2000 and 2255.
csubYY	The number of the Conventional Subsystem, where YY is a number between 1 and 47.
zoneZ	The number of the zone, where Z is a number between 1 and 7.

For information on DNS-related failures that may occur during or after DNS configuration, see the “AD/DNS Troubleshooting” chapter in the *Authentication Services* manual.

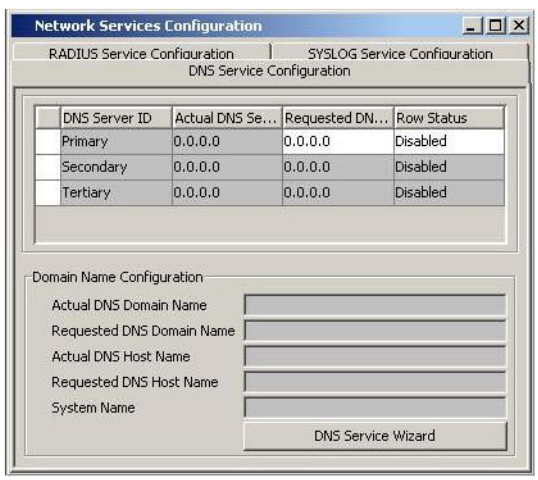
Procedure 4-9 How to Configure DNS Using CSS

<table>
<tr><td>1</td><td>Verify that you have IP addresses for a Primary, Secondary and/or Tertiary DNS Server IP. Contact your system administrator for this information if you do not have it before continuing to step 2.</td></tr>
<tr><td>2</td><td>Connect to the device using Configuration/Service Software (CSS) through an Ethernet port link. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10.</td></tr>
<tr><td>3</td><td>On the navigation pane, select Network Services Configuration.

Result: The Network Services Configuration window appears.</td></tr>
<tr><td>4</td><td>In the Network Services Configuration window, select the DNS Service Configuration tab.

Result: The DNS Service Configuration fields display as shown in Figure 4-5.

Figure 4-5 CSS Network Services Configuration - DNS Service Configuration Tab


</td></tr>
<tr><td>5</td><td>Enter the Requested DNS Server IP address for the Primary, Secondary, and Tertiary DNS servers.

NOTE

The Primary Row Status must be enabled before the Secondary row is ungrayed. The Secondary row status must be enabled before the Tertiary row is ungrayed. See Table 4-1, "DNS Nameservers for Devices in Dynamic System Resilience and Dynamic System Resilience Sites," on page 4-18.</td></tr>
<tr><td>6</td><td>In the Row Status field, select whether the IP address for the Primary, Secondary, or Tertiary DNS Server is Enabled or Disabled. Choose Enabled to use the DNS Server IP address.</td></tr>
</table>

Procedure 4-9 How to Configure DNS Using CSS (Continued)

7	In the **Requested DNS Domain Name** field, enter up to 191 alphanumeric characters. The Primary Row Status must be set to **Enabled** for this field to be active. NOTE Domain names for site devices should be based on the site ID and zone ID (such as siteX.zoneZ). See Table 4-1, "DNS Nameservers for Devices in Dynamic System Resilience and Dynamic System Resilience Sites," on page 4-18. For assistance in completing the Requested DNS Domain Name, click **DNS Service Wizard**.
8	In the **Requested DNS Host Name** field, enter up to 63 alphanumeric characters for the network in which this device resides. A Requested DNS Domain Name must be entered for this field to be active. NOTE This field is available only when configuring a conventional device AND a Requested DNS Domain Name has been entered. For assistance in completing the Requested DNS Host Name, click **DNS Service Wizard**.
9	The **System Name** field is not user editable and is only filled after using the DNS Service Wizard. NOTE This field is used only when configuring a conventional device.
10	Click **DNS Service Wizard** for assistance in completing the fields in the DNS Service Configuration screen. See the *CSS Online Help* for configuration details.
11	From the **File** menu, select **Save** to save the configuration changes.
12	Choose **File**, **Write Configuration to Device** to download the configuration changes on the device. NOTE For details on saving the configuration changes and then updating these changes on the device, see the *CSS Online Help*. **Result:** The DNS servers are configured for the device.

Customizing the Login Banner Using CSS

Procedure 4-10 describes how to edit the login banner's security notice.

Procedure 4-10 How to Customize the Login Banner Using CSS

1	Connect to the device using Configuration/Service Software (CSS) through an Ethernet port link. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10.
2	From the **Security** menu, select **Device Security Configuration**, and then select **Remote Access/Login Banner (Ethernet)**. **Result:** The Remote Access/Login Banner screen appears displaying the Remote Access Configuration tab.
3	Click on the **Login Banner** tab.
4	Edit the text of the banner.
5	Click one of the following: • **Refresh:** To re-read the original Login Banner text. • **Apply:** To save your changes and keep the screen open . • **OK:** To save your changes and close the screen. • **Close:** To close the screen without saving your changes.

Setting the SWDL Transfer Mode Using CSS

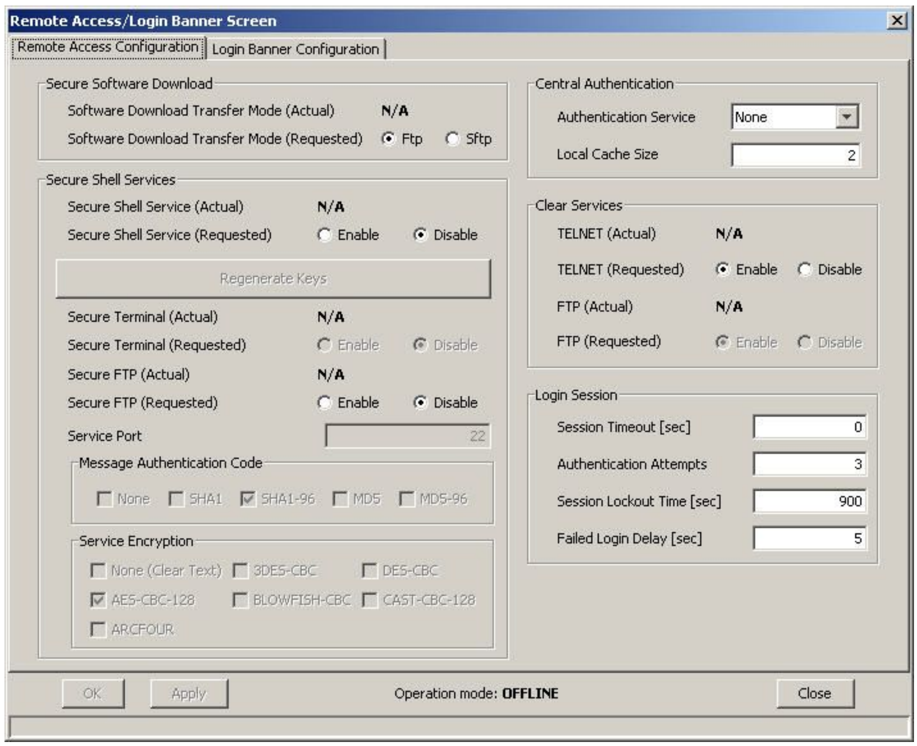
Procedure 4-11 describes how to set the SWDL transfer mode to FTP (clear) or SFTP (secure) for the device.

Procedure 4-11 How to Set the SWDL Transfer Mode Using CSS

1	Connect to the device using Configuration/Service Software (CSS) through an Ethernet port link. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10.
2	From the **Security** menu, select **Device Security Configuration**, and then select **Remote Access/Login Banner (Ethernet)**. **Result:** The Remote Access/Login Banner screen appears displaying the Remote Access Configuration tab.

Procedure 4-11 How to Set the SWDL Transfer Mode Using CSS (Continued)

Figure 4-6 Remote Access Configuration Tab



3 In the **Software Download Transfer Mode (Requested)** field, choose either Ftp (clear) or Sftp (secure), then choose **OK**.

NOTE

Secure Shell Service and Secure FTP services are automatically set to Enabled and grayed out when you choose Sftp.

Setting the NTP Server Settings

Network Time Protocol (NTP) provides a clock synchronization mechanism for various Network devices and computers. To allow the NTP server to provide date and time synchronization for a particular device, the NTP server's IP address must be entered on the Manager / NTP Definition Screen.

For security purposes, the base radio can restrict NTP messages to only those from the site controller. This is done by configuring two site controller IP addresses into the NTP Server IP Address fields on the base radio.

See the NTP Server Settings in the *CSS Online Help* for defining and entering these settings.

Setting Up the Local Password Configuration Using the CSS

Procedure 4-12 describes how to set the complexity requirements and controls for the local service account password. The updated password criteria is enforced on the next password change for the device's local service account.

Password Configuration is an optional feature. For information, see “Password Configuration" in the *CSS Online Help*.

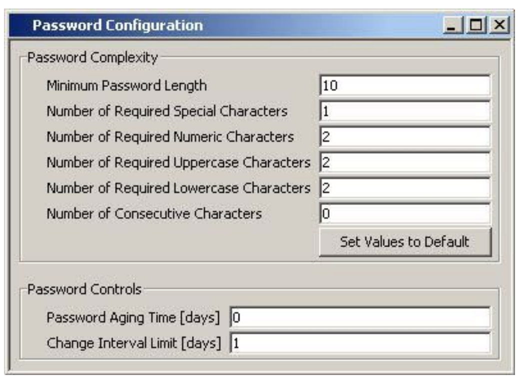
Procedure 4-12 How to Set the Local Password Configuration Using CSS

1 Connect to the device using Configuration/Service Software (CSS) through an Ethernet port link. See Procedure 4-4, "How to Connect Through an Ethernet Port Link," on page 4-10.

2 In the navigation pane, click the **Password Configuration** element.

Result: The Password Configuration window appears.

Figure 4-7 Password Configuration Window



3 Complete the following fields:

- **Minimum Password Length**—This field allows you to enter a value as the minimum length for the Password. The minimum can be between 8 and 255 characters, with a default of 10 characters.
- **Number of Required Special Characters**—This field allows you to enter a value for the required number of special characters which must be included in the Password. The value can be between 0 and 255, with a default of 1.
- **Number of Required Numeric Characters**—This field allows you to enter a value for the required number of numeric characters which must be included in the Password. The value can be between 0 and 255, with a default of 2.
- **Number of Required Uppercase Characters**—This field allows you to enter a value for the required number of uppercase alphabetic characters which must be included in the Password. The value can be between 0 and 255, with a default of 2.
- **Number of Required Lowercase Characters** —This field allows you to enter a value for the required number of lowercase alphabetic characters which must be included in the Password. The value can be between 0 and 255, with a default of 2.
- **Number of Consecutive Characters** —This field allows you to enter the maximum number of consecutive repeated characters that are permitted in the password.
- **Set Values to Default** —This returns all fields to their system default values.

Procedure 4-12 How to Set the Local Password Configuration Using CSS (Continued)

	• **Password Aging Time [days]** —This field allows you to enter a value between 0 and 65535 for the maximum number of days a device's local password will be valid. After the Password Aging Time has elapsed, the device's password must be changed. The default value is 0. • **Change Interval Limit [days]**—This field allows you to enter a value between 0 and 65535 for the number of days which must elapse before a device's local password can be changed. The default value is 1.
4	From the **File** menu, select **Save** to save the configuration changes.
5	Choose **File**, **Write Configuration to Device** to download the configuration changes on the device.

CSS Configuration Parameters for the GTR 8000 Base Radio (Trunked Simulcast)

Before proceeding with Process 4-3, complete the initial configuration of the device in Process 4-2, "Initially Configuring a Device Using CSS," on page 4-4.

Process 4-3 How to Configure a GTR 8000 Base Radio Using Configuration/ Service Software (CSS) for Trunked Simulcast

1	Connect to the base radio through an Ethernet port link and then read the configuration file from the base radio. See "Connecting Through an Ethernet Port Link".
2	Click on **System** in the System tree and enter a hexadecimal value (between 001 and FFE) in the **System Id** field.
3	Click on **Site** in the System tree and complete the fields.
4	Click on **Channel** in the System tree and complete the fields.
5	Click on **Subsite** in the System tree and complete the fields.
6	Click on **Configuration** in the System tree and complete the fields on all four tabs. **NOTE** As part of RMC configuration, you will need to set the DIP switches on the RMC/LNA modules. See "Setting RMC System Gain".
7	Click on **Network Services Configuration** in the System tree and complete the fields on the three tabs. **NOTE** For configuration details for DNS and RADIUS Services, see the *Authentication Services* manual. For configuration details for SYSLOG Services, see the *Centralized Event Logging*, manual.

Process 4-3 How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for Trunked Simulcast (Continued)

8	Click on **Password Configuration** in the System tree and complete the fields. NOTE Password Configuration is only required if you have passwords entered for local accounts. This sets the password complexity and controls. For details on password complexity and controls see “Password Configuration” in *CSS Online Help*.
9	Save the configuration data to a new archive file using **Save As** on the **File** menu or overwrite the existing archive file by using **Save** on the **File** menu. IMPORTANT Be sure to save any configuration changes to a local or network drive so that if the base radio's transceiver module fails, you can load your settings to a replacement base radio transceiver. If the configuration file is not saved to a local or network drive, you will need to repeat the set up steps after replacing a transceiver module.
10	Write the configuration data to the base radio, as follows: • From the **File** menu bar, select **Write Configuration to Device**.

For configuration parameters on each field for a trunked simulcast GTR 8000 Base Radio, see "Multi-Site or Simulcast Subsystem" in the *CSS Online Help*.

CSS Configuration Parameters for the GTR 8000 Base Radio (Trunked Repeater)

Before proceeding with Process 4-4, complete the initial configuration of the device in Process 4-2, "Initially Configuring a Device Using CSS," on page 4-4.

Process 4-4 How to Configure a GTR 8000 Base Radio Using Configuration/ Service Software (CSS) for Trunked Repeater

1	Connect to the base radio through an Ethernet port link and then read the configuration file from the base radio. See “Connecting Through an Ethernet Port Link”.
2	Click on **System** in the System tree and enter a hexadecimal value (between 001 and FFE) in the **System Id** field.
3	Click on **Site** in the System tree and complete the fields.
4	Click on **Channel** in the System tree and complete the fields.

Process 4-4 How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for Trunked Repeater (Continued)

5 Click on **Configuration** in the System tree and complete the fields on all four tabs.

NOTE

As part of RMC configuration, you will need to set the DIP switches on the RMC/LNA modules. See “Setting RMC System Gain”.

6 Click on **Network Services Configuration** in the System tree and complete the fields on the three tabs.

NOTE

For configuration details for DNS and RADIUS Services, see the *Authentication Services* manual. For configuration details for SYSLOG Services, see the *Centralized Event Logging*, manual.

7 Click on **Password Configuration** in the System tree and complete the fields.

NOTE

Password Configuration is only required if you have passwords entered for local accounts. This sets the password complexity and controls. For details on password complexity and controls see “Password Configuration” in *CSS Online Help*.

8 Save the configuration data to a new archive file using **Save As** on the **File** menu or overwrite the existing archive file by using **Save** on the **File** menu.

IMPORTANT

Be sure to save any configuration changes to a local or network drive so that if the base radio's transceiver module fails, you can load your settings to a replacement base radio transceiver. If the configuration file is not saved to a local or network drive, you will need to repeat the set up steps after replacing a transceiver module.

9 Write the configuration data to the base radio, as follows:

- From the **File** menu bar, select **Write Configuration to Device**.

For configuration parameters for a trunked Repeater GTR 8000 Base Radio, see "Repeater Site Subsystem" in the *CSS Online Help*.

CSS Configuration Parameters for the GTR 8000 Base Radio (HPD)

This section describes the configuration procedures for an HPD GTR 8000 Base Radio.

Before proceeding with Process 4-5, complete the initial configuration of the device in Process 4-2, "Initially Configuring a Device Using CSS," on page 4-4.

Process 4-5 How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for HPD

1	Connect to the base radio through an Ethernet port link and then read the configuration file from the base radio. See "Connecting Through an Ethernet Port Link".
2	Click on**System** in the System tree and enter a hexadecimal value (between 001 and FFE) in the **System Id** field.
3	Click on **Site** in the System tree and complete the fields.
4	Click on **Channel** in the System tree and complete the fields.
5	Click on **Configuration** in the System tree and complete the fields on all four tabs. **NOTE** As part of RMC configuration, you will need to set the DIP switches on the RMC/LNA modules. See "Setting RMC System Gain".
6	Click on **Network Services Configuration** in the System tree and complete the fields on the three tabs. **NOTE** For configuration details for DNS and RADIUS Services, see the *Authentication Services* manual. For configuration details for SYSLOG Services, see the *Centralized Event Logging*, manual.
7	Click on **Password Configuration** in the System tree and complete the fields. **NOTE** Password Configuration is only required if you have passwords entered for local accounts. This sets the password complexity and controls. For details on password complexity and controls see "Password Configuration" in *CSS Online Help*.
8	Save the configuration data to a new archive file using **Save As** on the **File** menu or overwrite the existing archive file by using **Save** on the **File** menu. **IMPORTANT** Be sure to save any configuration changes to a local or network drive so that if the base radio fails, you can load your settings to a replacement base radio. If the configuration file is not saved to a local or network drive, you will need to repeat the set up steps after replacing a base radio.

Process 4-5 How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for HPD (Continued)

9	Write the configuration data to the base radio, as follows: • From the **File** menu bar, select **Write Configuration to Device**.

For configuration parameters for an HPD GTR 8000 Base Radio, see "HPD Remote/Expandable Site" in the *CSS Online Help*.

CSS Configuration Parameters for the GTR 8000 Base Radio (Conventional)

NOTE

The Ethernet Type field for a standalone conventional base radio must be set to 10Mbit, half-duplex.

Before proceeding with Process 4-6, complete the initial configuration of the device in Process 4-2, "Initially Configuring a Device Using CSS," on page 4-4.

Process 4-6 How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for Conventional

1	Connect to the base radio through an Ethernet port link and then read the configuration file from the base radio. See “Connecting Through an Ethernet Port Link”.
2	Click on **Site** in the System tree and complete the fields.
3	Click on **Hardware Configuration** in the System tree and complete the fields on the two tabs. **NOTE** As part of RMC configuration, you will need to set the DIP switches on the RMC/LNA modules. See “Setting RMC System Gain”.
4	Click on **Options** in the System tree and complete the fields.
5	Click on **Infrastructure Interface** in the System tree and complete the fields on the three tabs.
6	Click on **Channel Configuration** in the System tree and complete the fields.
7	Click on **Repeater Configuration** in the System tree and complete the fields.
8	Click on **Receiver Scan** in the System tree and complete the fields.
9	Click on **Repeater Access** in the System tree and complete the fields.
10	Click on **WildCard Tables** in the System tree and complete the fields on the three tabs.

Process 4-6 How to Configure a GTR 8000 Base Radio Using Configuration/Service Software (CSS) for Conventional (Continued)

11 Click on **Network Services Configuration** in the System tree and complete the fields on the three tabs.

NOTE

For configuration details for RADIUS Services, see the *Authentication Services* manual. For configuration details for SYSLOG Services, see the *Centralized Event Logging*, manual.

12 Click on **Password Configuration** in the System tree and complete the fields.

NOTE

Password Configuration is only required if you have passwords entered for local accounts. This sets the password complexity and controls. For details on password complexity and controls see “Password Configuration” in *CSS Online Help*.

13 Save the configuration data to a new archive file using **Save As** on the File menu or overwrite the existing archive file by using **Save** on the **File** menu.

IMPORTANT

Be sure to save any configuration changes to a local or network drive so that if the base radio fails, you can load your settings to a replacement base radio. If the configuration file is not saved to a local or network drive, you will need to repeat the set up steps after replacing a base radio.

14 Write the configuration data to the base radio, as follows:

- From the **File** menu bar, select **Write Configuration to Device**.

For configuration parameters for an ASTRO® 25 Conventional GTR 8000 Base Radio, see "Conventional Site - Digital Only" in the *CSS Online Help*. For configuration parameters for an analog conventional GTR 8000 Base Radio, see "Conventional Site - Analog/Mixed Mode" in the *CSS Online Help*.

Using VoyenceControl to Configure Centralized Authentication on Devices

This section provides the process for configuring centralized authentication on devices using the VoyenceControl component of Motorola's Unified Network Configurator (UNC) application.

Follow Process 4-7 to configure the device using VoyenceControl. This does not apply for a K1/K2 or non-networked site.

Process 4-7 Device Configuration Process Using VoyenceControl

1	Configure Domain Name Service (DNS) on the device. See Chapter 7, “Configuring DNS on RF Site and VPM Devices Using VoyenceControl” in the *Authentication Services* manual.
2	Configure Authentication Sources for the device. See Chapter 7, “Configuring Authentication Sources for RF Site and VPM Devices Using VoyenceControl in the *Authentication Services* manual.
3	Configure RADIUS parameters for the device. See Chapter 7, “Configuring Radius Parameters for RF Site and VPM Devices Using VoyenceControl” in the *Authentication Services* manual.
4	Set the Local Cache Size for Centralized Authentication for the device. See Chapter 7, “Setting the Local Cache Size for Central Authentication on RF Site and VPM Devices Using VoyenceControl” in the *Authentication Services* manual.
5	Enable/Disable Centralized Authentication for the device. See Chapter 7, “Enabling/Disabling Centralized Authentication on RF Site and VPM Devices Using VoyenceControl” in the *Authentication Services* manual.
6	Enable/Disable Centralized Event Logging for the device. See Chapter 6, “Enabling/Disabling Centralized Event Logging on RF Site Devices and VPM's Using VoyenceControl” in the *Centralized Event Logging* manual.

Configuring Tx Power Values and Battery Type

As part of the site configuration process, you need to select your Battery Type and Tx Power Level (Battery Backup) on the Hardware Configuration tab in Configuration/Service Software (CSS). You can also use this Hardware Configuration tab to set Tx Power Out.

NOTE

You will need to locate the IP address for the base radio before performing this procedure. Contact your system administrator for this information.

Procedure 4-13 How to Configure Tx Power Values and Battery Type for GTR 8000 Base Radio Configurations

1	Open Configuration/Service Software (CSS).
2	Connect to the device through an Ethernet port link and then read the configuration file from the device. See “Connecting Through an Ethernet Port Link”.
3	Select **Read Configuration from Device** from the File menu.

Procedure 4-13 How to Configure Tx Power Values and Battery Type for GTR 8000 Base Radio Configurations (Continued)

4	Select **Configuration** from the navigation tree in the left pane.
5	Select the **Hardware Configuration** tab in the right pane.
6	Enter a value in the field labeled **Tx Power Out (Watts)** in the right pane.
7	Enter a value in the field labeled **Tx Power Level Battery Backup (Watts)** in the right pane.
8	Select your Battery Type (manufacturer and model, or select the generic listing for your class of battery).
9	Save your configuration to an archive on your local or network drive by selecting **Save** or **Save As** from the File menu.
10	Save your configuration to the base radio's non-volatile memory by selecting **Write Configuration to Device** from the File menu. **Result:** The system uses the values you entered.

Setting RMC System Gain

The RMC system gain must be set up according to your GTR 8000 Base Radio configuration. Procedure 4-14 provides instructions for setting up system gain using Configuration/Service Software (CSS).

NOTE

For standalone base radios, you must calculate and enter a value for system gain. Calculate the system gain from the receiver multicoupler input to the base radio Rx input. If there is no multicoupler, enter zero.

NOTE

You will need to locate the IP address for the base radio before performing this procedure. Contact your system administrator for this information.

Procedure 4-14 How to Set GTR 8000 RMC System Gain

1	Open Configuration/Service Software (CSS).
2	Connect to the device through an Ethernet port link and then read the configuration file from the device. See “Connecting Through an Ethernet Port Link”.
3	Select **Read Configuration from Device** from the **File** menu.

Procedure 4-14 How to Set GTR 8000 RMC System Gain (Continued)

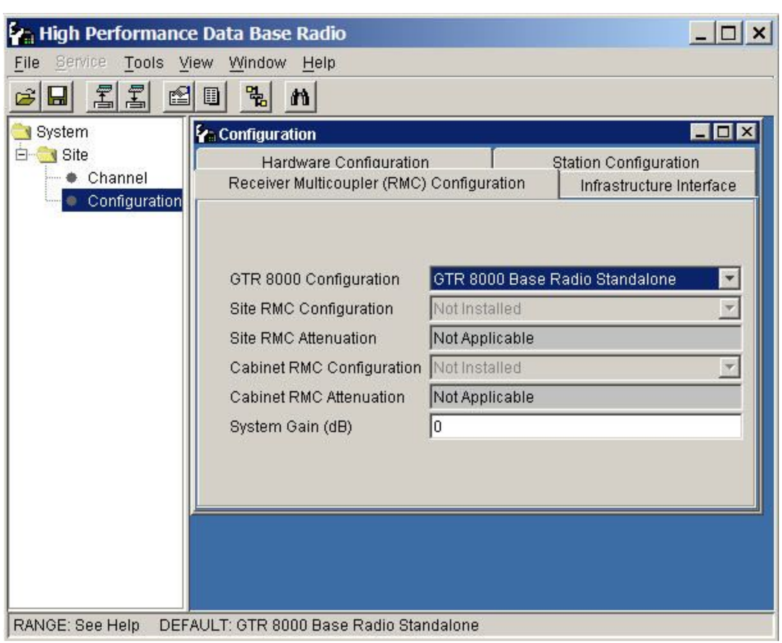
4	Select **Configuration** from the navigation tree in the left pane.
5	Select the **Receive Multicoupler (RMC) Configuration** tab in the right pane.
6	Select your configuration, using the fields indicated in Table 4-3. **Result:** For a Standalone Base Radio, you must enter a dB value in the System Gain field.
7	Save your RMC configuration to an archive on your local or network drive by selecting **Save** or **Save As** from the File menu.
8	Save your RMC configuration to the base radio's non-volatile memory by selecting **Write Configuration to Device** from the File menu. **Result:** The resulting system gain is automatically used by the RMCs. In addition, an appropriate transceiver attenuation is automatically calculated, saved in the configuration file, and used.

Table 4-3 shows what to select on the RMC Configuration tab in Figure 4-8. It also displays the resulting values that CSS will display in the System Gain field and include in the RMC configuration settings.

Table 4-3 RMC System Gain for GTR 8000 Base Radio Configurations

Your Configuration	What to select on Configuration/Service Software (CSS) Receive Multicoupler (RMC) Configuration tab	Resulting System Gain
Standalone Base Radio	**1.** GTR 8000 Configuration field: Select **GTR 8000 Base Radio Standalone**	User enters the value

Figure 4-8 CSS RMC Configuration tab with GTR 8000 Standalone Selected



Chapter

5

GTR 8000 Base Radio Optimization

Your Motorola Field Representative or Motorola System Support Center (SSC) can advise you on optimization activities required for your system, if any. See “Using System Support Center (SSC)” in the Troubleshooting section of the documentation.

This chapter contains optimization procedures and recommended settings relating to GTR 8000 Base Radio.

Aligning the Internal Frequency Reference Oscillator

The transceiver option card within a base radio or receiver provides an internal 10 MHz frequency reference which can be used as the primary or backup frequency reference source for the device. For conventional base radio/receiver operation, it also provides the analog interfaces and wildcard I/Os.

After a base radio or receiver is installed or after the transceiver option card is replaced, the internal frequency reference oscillator must be aligned.

The transceiver option card internal frequency reference oscillator must be aligned to within 10 ppb (parts per billion). The measuring equipment used to make this alignment should be accurate to within 10 ppb. This accuracy typically requires test equipment with a double oven or a Rubidium reference oscillator.

NOTE

The base radio or receiver must be turned on for at least one week before the internal frequency reference oscillator is aligned.

The internal frequency reference oscillator for an OCXO transceiver option card must be aligned:

- Upon installation of the base radio or receiver for all bands.
- Once every two years after installation for 700/800 MHz systems.
- Once every five years after installation for UHF systems.
- VHF systems do not require alignment after initial installation.

The internal frequency reference oscillator for a TCXO transceiver option card must be aligned:

- Upon installation of the base radio or receiver for UHF.

- Every year after installation for UHF.

The internal frequency reference oscillator can be aligned using two methods: manual alignment or auto alignment.

NOTE

The internal frequency reference oscillator can only be aligned on a GPW 8000 Receiver using the auto alignment procedure.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

GTR 8000 Base Radio Time and Frequency Inputs

A variety of external time and frequency inputs can be provided to the base station for normal operation or for Internal Frequency Reference Oscillator alignment. The following table provides a list of acceptable input signal types and levels for each base radio input port.

Table 5-1 Base Radio Time and Frequency Inputs

Input Port	Frequency	Waveform	Level	Impeda-nce	Note
Ext Freq Ref	5 MHz	Sine	2.6–5.3 Vpp	100 kohms	AC coupled
Ext Freq Ref	5 MHz	Square	45–55% duty cycle	100 kohms	AC coupled
Ext Freq Ref	10 MHz	Sine	2.6–5.3 Vpp	100 kohms	AC coupled
Ext Freq Ref	10 MHz	Square	45-55% duty cycle	100 kohms	AC coupled
Ext Freq Ref	20 MHz	Sine	2.6–5.3 Vpp	100 kohms	AC coupled
Ext Freq Ref	20 MHz	Square	45–55% duty cycle	100 kohms	AC coupled
Ext Freq Ref	5 MHz/1PPS*	Square	2.6–5.3 Vpp	100 kohms	AC coupled; 25% modulation 1pps arrives on 75% duty cycle
1 PPS	1 PPS	Pulse	2.6–5.3 Vpp	100 kohms	DC coupled
Front Panel Ext Freq Ref	5 MHz	Sine	2–5 Vpp; 10–18 dBm	50 ohms	AC coupled
Front Panel Ext Freq Ref	5 MHz	Square	45–55% duty cycle	50 ohms	AC coupled
Front Panel Ext Freq Ref	10 MHz	Sine	2–5 Vpp; 10–18 dBm	50 ohms	AC coupled

Table 5-1 Base Radio Time and Frequency Inputs (Continued)

Input Port	Frequency	Waveform	Level	Impeda-nce	Note
Front Panel Ext Freq Ref	10 MHz	Square	45–55% duty cycle	50 ohms	AC coupled
Front Panel Ext Freq Ref	5 MHz/1PPS*	Square	2.6–5.3 Vpp	50 ohms	AC coupled; 25% modulation 1pps arrives on 75% duty cycle

* 25% modulation, 1 PPS arrives on 75% duty cycle.

NOTE

The Front Panel EXT FREQ REF connection is the Frequency Calibrator (BNC connector) on the transceiver module.

Equalizing the Battery

Battery Equalization configures the power supply to set the proper charge and capacity for the storage batteries connected to the base radio. Sites equipped with storage batteries that provide base radio power in case of primary power failure require the battery cells to be equalized periodically.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

NOTE

Some batteries do not require equalization. See the battery manufacturer recommendations.

Aligning ASTRO Simulcast (Trunked Operation)

ASTRO Simulcast Alignment is used to enter a Launch Time Offset value (range 0.0 to 1000.0 usec), store the value in the base radio, and initiate a simulcast test pattern.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

Aligning ASTRO/Analog Simulcast (Conventional Operation)

In an ASTRO simulcast subsystem, all station transmitters are synchronized to a 1 pulse per second (pps) signal from a global positioning satellite (GPS) receiver. The 1 pps signal provides a common time reference for each of the transmitters. The ASTRO signaling information arriving at the station transmitter includes timestamps that specify the transmit offset delay for the voice and data transmissions.

To allow the user to adjust the overlap coverage areas, the ASTRO/Analog Alignment screen is provided to allow the user to specify a launch time offset value, with a 0.1 µs resolution. This value is added to the arriving launch time value to provide an adjusted launch time. The specified ASTRO simulcast transmit offset delay value applies only to ASTRO simulcast subsystems and is considered optional. The default offset value is 0 (zero), causing no adjustment to the launch time specified by the arriving timestamp value.

For Analog Simulcast, the Transmit Offset Delay merely delays the Analog Simulcast Audio to provide the adjustment in the overlap coverage areas.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

Aligning Carrier Squelch

A Carrier Squelch (CSQ) Alignment is typically performed at an RF level which corresponds to 12 dB SINAD, or an RF level which corresponds to 20 dB quieting, or any other RF level selected by the user.

The CSQ Alignment screen facilitates the measurement of 12 dB SINAD for the base radio under test by allowing the Rx Qualifiers to be set to Open. When the Rx Qualifiers are set to Open, receive audio is gated to the WL2 wireline port or to the speaker, regardless of the RF input level. The preferred SINAD measurement port is the WL2 wireline port; however, the speaker can also be used.

When measuring SINAD, the pre-emphasis and High Pass filters are set as they would be for analog voice operation. Since the channel characteristics are different, this procedure allows for CSQ Alignment to be done for both 12.5 kHz and 25 kHz channel bandwidth. If the station is configured for only one channel bandwidth, there is no need to perform a CSQ Alignment for the other bandwidth.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

Aligning Tx Wireline

Tx Wireline Alignment is used to set the levels which will result in 60% system deviation for both Wireline Level Line 1(WL1) and Wireline Level Line 3 (WL3) and for setting the Wireline Squelch levels.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

Aligning Rx Wireline

Rx Wireline Alignment is only used for a base radio that processes analog receive audio and is connected with a 2– or 4–wire link to a console or a comparator in an analog only topology or an ASTRO analog mixed mode topology.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

Tuning a Preselector

The optional VHF or UHF preselector assembly is mounted on the back of a base radio or base receiver. The preselector assembly is a 3-pole (UHF) or a 5-pole (VHF) bandpass filter equipped with tuning slugs to adjust the passband corresponding to the operating frequency(s) of the base radio. The preselector assembly must be field tuned if replaced in the field or if the base radio operating frequency(s) are modified.

IMPORTANT

Tuning for best SINAD or BER response DOES NOT result in optimum tuning of the preselector assembly. You must use this field tuning procedure to obtain optimum preselector performance.

The following test equipment is required to properly tune the preselector assembly:

- RF Signal Generator - Aeroflex 3900 Series Service Monitor
- Dip/peak Monitor - HP435B Power Meter (or equivalent) with HP8484A sensitive power head, Boonton Model 92E with BNC input, or Aeroflex 3900 Series Service Monitor using the spectrum analyzer function
- Torque driver capable of delivering 12 in -lbs of torque and 10 mm deep well socket
- Tuning probe - Motorola Part No. 3082059X01, p/o TRN4083A tuning kit
- Flat-blade screwdriver

NOTE

An R2600 Communications Analyzer can both generate and measure simultaneously. A service monitor may be used for either the generator or the monitor function, but not both simultaneously. When using service monitor as the signal generator, RF signal must be taken from the Antenna port.

VHF Tuning Procedure

Calculating Proper VHF Alignment Frequency

Use one of the following two methods to calculate the VHF alignment frequency to be generated by the signal generator.

For base radios with a single receive frequency, calculate the frequency of the alignment signal as follows:

Procedure 5-1 How To Calculate The VHF Alignment Frequency for a Single Receive Frequency

1	From the site documentation or the CSS, determine the base radio receive frequency.
2	If the frequency is ≤148 MHz or ≥156 MHz, subtract 250 kHz. Otherwise, note the actual frequency. **Example:** If the base radio receive frequency is 138.575 MHz, subtract 250 kHz because the frequency is less than 148 MHz: 138.575 MHz – 250 kHz =138.325 MHz
3	If the preselector is Range 1 (136–154 MHz), determine the alignment frequency as follows: If frequency (from Step 2) is > 152 MHz, then alignment frequency = 152 MHz. Otherwise, use actual frequency from Step 2.
4	If the preselector is Range 2 (150–174 MHz), determine the alignment frequency as follows: If the frequency (from Step 2) is < 152 MHz, then alignment frequency = 151 .75 MHz.

Procedure 5-1 How To Calculate The VHF Alignment Frequency for a Single Receive Frequency (Continued)

	If frequency (from Step 2) is > 172 MHz, then alignment frequency =172 MHz. Otherwise, use actual frequency from Step 2.

For base radios/receivers with multiple receive frequencies, calculate the frequency of the alignment signal as follows:

Procedure 5-2 How To Calculate The VHF Alignment Frequency For Multi Receive Frequencies

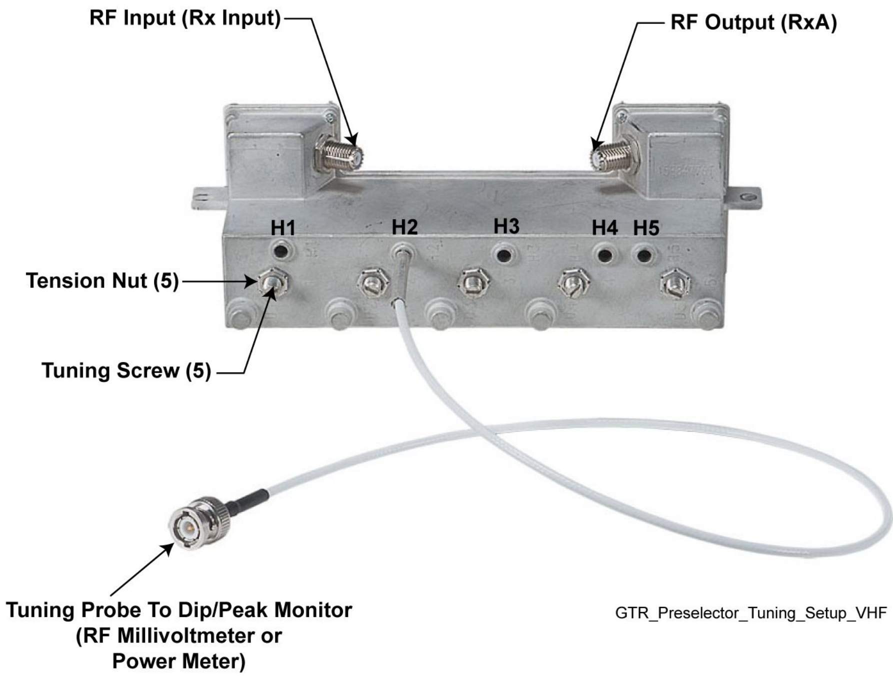
1	From the site documentation or the CSS, note the receive frequency for each channel supported by the base radio/receiver.
2	Calculate a midpoint frequency as follows: $F_{mid} = (F_{highest} + F_{lowest}) \div 2$
3	Using F_{mid} in place of the base radio/receiver receive frequency, perform steps 3 and 4 from Procedure 5-1.

Preparing the Equipment for VHF Alignment

Procedure 5-3 How To Prepare The Equipment For VHF Alignment

1	Make sure the base radio/receiver (with preselector assembly) is installed in a functional station cage equipped with a power supply module.
2	Detune the preselector as follows: **1.** If the alignment frequency (calculated in Procedure 5-1 or Procedure 5-2) is greater than 148 MHz (Range 1) or 156 MHz (Range 2), turn the five tuning screws clockwise until 1/8" protrudes past each of the tension nuts. **2.** If the alignment frequency is less than or equal to 148 MHz (Range 1) or 156 MHz (Range 2), turn the five tuning screws counterclockwise until 3/4" protrudes past each of the tension nuts.
3	Using the torque driver and deep well socket, tighten the five tension nuts on the adjustment screws to 6 in-lbs.
4	See Figure 5-1.

Figure 5-1 Preselector Tuning — VHF



VHF Tuning Procedure

See Figure 5-1 for the location of the tuning screws and cavity probe holes.

IMPORTANT

When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to verify that you have obtained a true peak or dip. After ensuring you have found true peak or dip, turn the screw back to the location of the original peak or dip.

Procedure 5-4 How to Tune the VHF Preselector

1	Turn the base radio/receiver power supply ON (to provide a 50 Ohm termination).
2	Adjust the signal generator to the frequency calculated in Procedure 5-1 or Procedure 5-2. Set the level to +5 dBm.
3	Insert tuning probe into cavity H1 and adjust tuning screw 1 for a **PEAK**.
4	Leave tuning probe in cavity H1 and adjust tuning screw 2 for a **DIP**.
5	Insert tuning probe into cavity H2 and adjust tuning screw 3 for a **DIP**.
6	Insert tuning probe into cavity H3 and adjust tuning screw 4 for a **DIP**.
7	Insert tuning probe into cavity H4. Decrease output from signal generator to –5 dBm.
8	Adjust tuning screw 5 for a **DIP**. Then turn tuning screw 5 an additional 1/4 turn counterclockwise. (Note that dip will not be as sharp for screw 5 as it was for screws 2 through 4.)

UHF Tuning Procedure

Calculating Proper UHF Alignment Frequency

Use one of the following two methods to calculate the alignment frequency to be generated by the signal generator.

For base radios with a single receive frequency, calculate the frequency of the alignment signal as follows:

Procedure 5-5 How To Calculate The UHF Alignment Frequency for a Single Receive Frequency

1	From the site documentation or the CSS, determine the base radio receive frequency. **Add 200 kHz**.
2	If base radio/receiver is 380–435 MHz, determine the alignment frequency as follows: If frequency (from Step 1) is > 431 MHz, then alignment frequency = 431 MHz. If frequency (from Step 1) is < 382 MHz, then alignment frequency = 382 MHz. Otherwise, use actual frequency from Step 1.
3	If the base radio/receiver is 435–470 MHz, determine the alignment frequency as follows: If the frequency (from Step 1) is > 468 MHz, then alignment frequency = 468 MHz. If frequency (from Step 1) is < 440 MHz, then alignment frequency =440 MHz. Otherwise, use actual frequency from Step 1.
4	If the base radio/receiver is 470–524 MHz, determine the alignment frequency as follows: If the frequency (from Step 1) is > 518 MHz, then alignment frequency = 518 MHz. If frequency (from Step 1) is < 472 MHz, then alignment frequency =472 MHz. Otherwise, use actual frequency from Step 1.

For base radios/receivers with multiple receive frequencies, calculate the frequency of the alignment signal as follows:

Procedure 5-6 How To Calculate The UHF Alignment Frequency For Multi Receive Frequencies

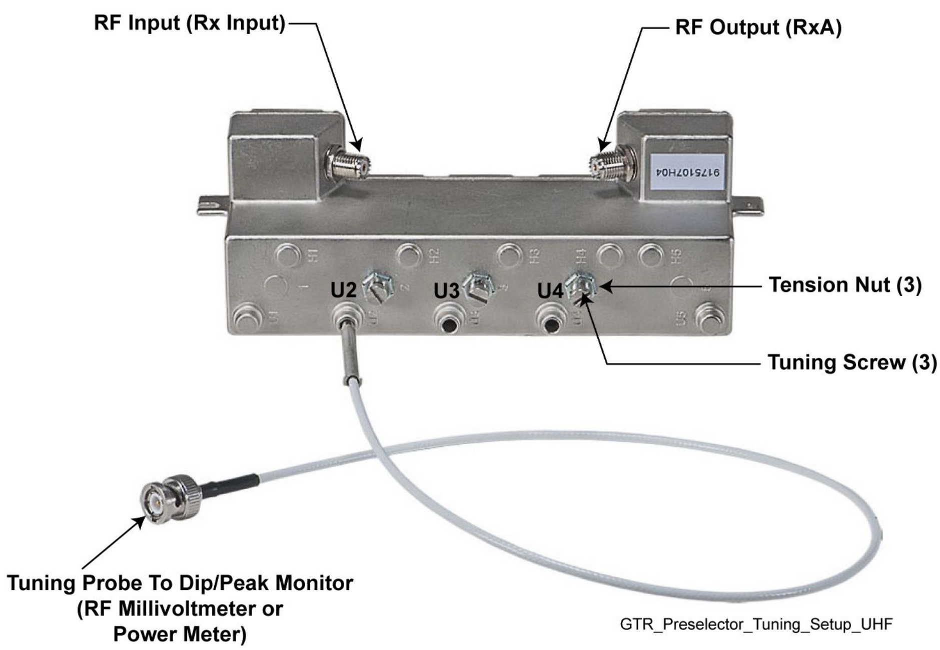
1	From the site documentation or the CSS, note the receive frequency for each channel supported by the base radio/receiver.
2	Calculate a midpoint frequency as follows: $F_{mid} = (F_{highest} + F_{lowest}) \div 2$
3	Using F_{mid} in place of the base radio receive frequency, perform steps 1 through 4 from Procedure 5-5.

Preparing the Equipment for UHF Alignment

Procedure 5-7 How To Prepare The Equipment For UHF Alignment

1	Make sure base radio/receiver (with preselector assembly) is installed in a functional station cage equipped with a power supply module.
2	Using the torque driver and deep well socket, loosen the three tension nuts on the adjustment screws.
3	Detune the preselector by turning tuning screws **3** and **4** clockwise until they bottom out. Be careful not to apply more than 3 in-lbs of torque to prevent warping preselector cover and housing.
4	See Figure 5-2.

Figure 5-2 Preselect Tuning — UHF



UHF Tuning Procedure

See Figure 5-2 for the location of the tuning screws and cavity probe holes.

IMPORTANT

When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to verify that you have obtained a true peak or dip. After ensuring you have found true peak or dip, turn the screw back to the location of the original peak or dip.

Procedure 5-8 How to Tune The UHF Preselector

1	Turn the base radio power supply ON (to provide a 50 Ohm termination).
2	Adjust the signal generator to the frequency calculated in Procedure 5-5 or Procedure 5-6. Set the level to +5 dBm.
3	Insert tuning probe into cavity U2 and adjust tuning screw 2 for a **PEAK**.
4	Tighten tension nut on tuning screw 2 to at least 12 in-lb and fine tune tuning screw 2 for a **PEAK**.
5	Keep tuning probe in cavity U2 and adjust tuning screw 3 for a **DIP**.
6	Tighten tension nut on tuning screw 3 to at least 12 in-lb and fine tune tuning screw 2 for a **DIP**.
7	Insert tuning probe into cavity U3. Decrease output from signal generator to –5 dBm.
8	Adjust tuning screw 4 for a **DIP**.
9	Tighten tension nut on tuning screw 4 to at least 12 in-lb and fine tune tuning screw 4 for a **DIP**.

Tuning a Duplexer

Duplexer modules shipped with base radios are tuned at the factory. If a duplexer must be replaced in the field, the unit must be installed and tuned specifically to the transmit and receive frequency pair for the particular base radio.

Field Tuning Overview

NOTE

These tuning procedures are valid for channels with a bandwidth of 200 kHz or less. If bandwidth is more than 200 kHz, the duplexer must be tuned by the service depot.

The duplexer module is comprised of three low-pass/high-notch cavities and three high-pass/low-notch cavities. Each set of three cavities provides bandpass filtering for either the transmit RF signal or the receive RF signal. In general, the duplexer must be tuned so that the transmit cavity set passes the transmit signal and rejects the receive signal; concurrently, the receive cavity set must be tuned to pass the receive signal and reject the transmit signal.

Tuning is performed by injecting RF signals and making tuning adjustments (using the tuning rods and trimmer screws) while monitoring for maximum or minimum readings on the RF millivoltmeter. Field tuning the duplexer module requires the following general adjustments:

- Tune high-pass/low-notch cavities for maximum pass and reject response
- Tune low-pass/high-notch cavities for maximum pass and reject response
- Check high-pass/low-notch and low-pass/high-notch cavities for insertion loss
- Check high-pass/low-notch and low-pass/high-notch cavities for isolation

Required Test Equipment

Reid tuning of the duplexer module requires the following test equipment:

- RF Signal Generator - Aeroflex 3900 Series Service Monitor
- RF Millivoltmeter (Boonton 92E or equivalent)
- 50 Ohm N-type terminator
- Tuning tool (5/32" x 4" screwdriver) (UHF)
- Male-to-Females N-Type "T" connector (UG-107B/U or equivalent) (VHF)
- Slotted screwdriver (VHF)
- 3/32" Allen wrench (VHF)
- Tuning tool (thin blade) (VHF)
- N-to-N bullet connector (UG29A/U or equivalent)
- 7/16" Nutdriver (UHF)
- 7/16" Open End Wrench (UHF)
- N-to-BNC Adapter (UG349A/U)
- N-to-N Connector (UG57B/U)

Tuning a 700/800 MHz Duplexer

No field tuning is needed on a 700 or 800 MHz duplexer. The duplexers are pre-tuned to operate over the entire sub-band.

Tuning a VHF Duplexer

The following procedures are most easily performed with the duplexer module removed from the rack or cabinet. Be sure to make note of the transmit and receive frequencies for the particular base radio before beginning.

If the duplexer module is tuned according to instructions and does not meet specifications for return loss, insertion loss, and/or isolation, you must return the duplexer for repair.

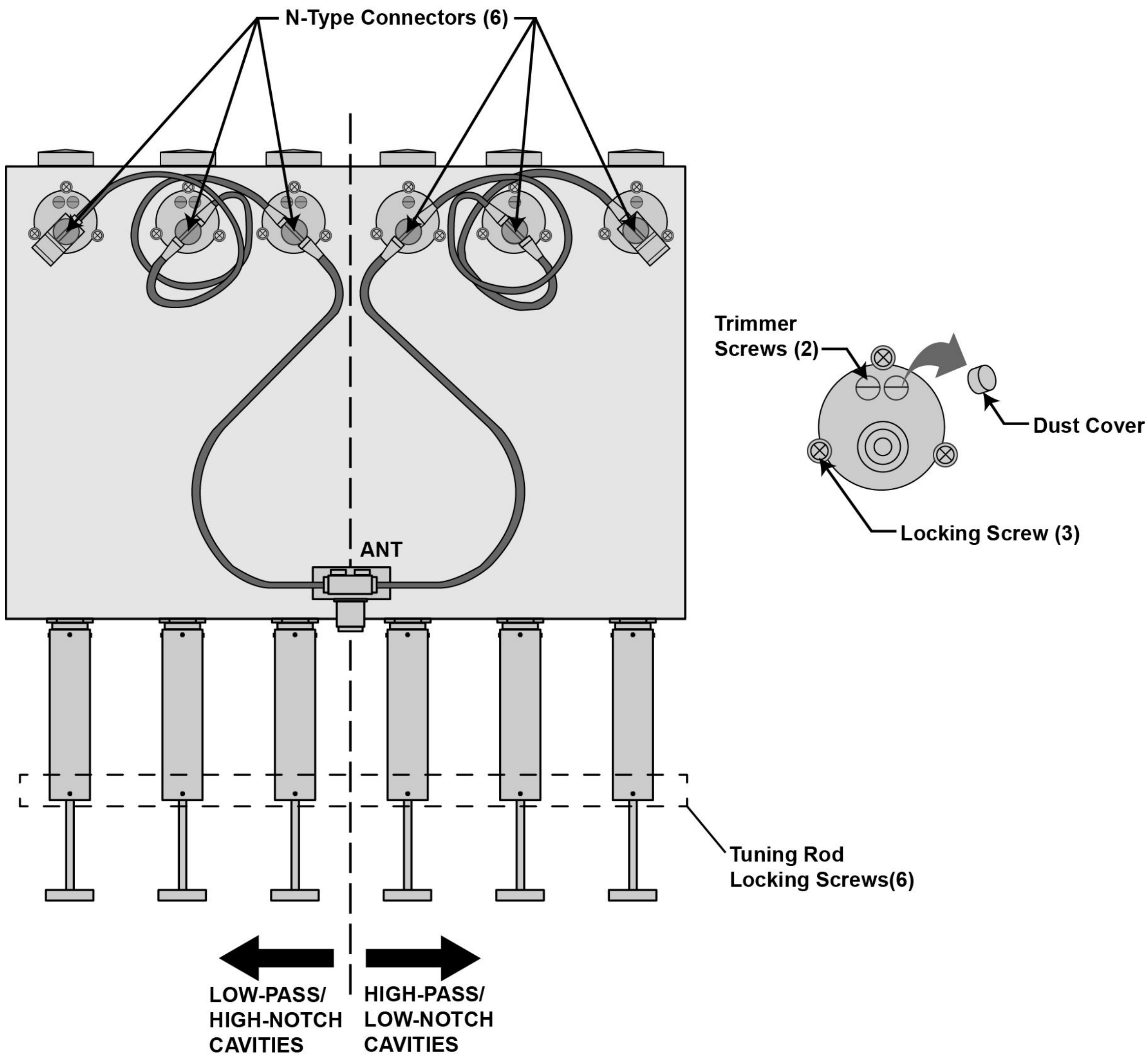
Setting Up for Tuning a VHF Duplexer

Perform the tasks in Procedure 5-9 prior to tuning the VHF duplexer module. See Figure 5-3.

Procedure 5-9 How To Setup Tuning the VHF Duplexer

1	Disconnect the 6 N-type connectors from each cavity.
2	For each cavity, unscrew and remove trimmer screw dust covers (9).
3	Use an Allen wrench and loosen the tuning rod locking screws (6).

Figure 5-3 VHF Duplexer Tuning Setup



VHF_Setting_Up_Tuning_Duplexer_A

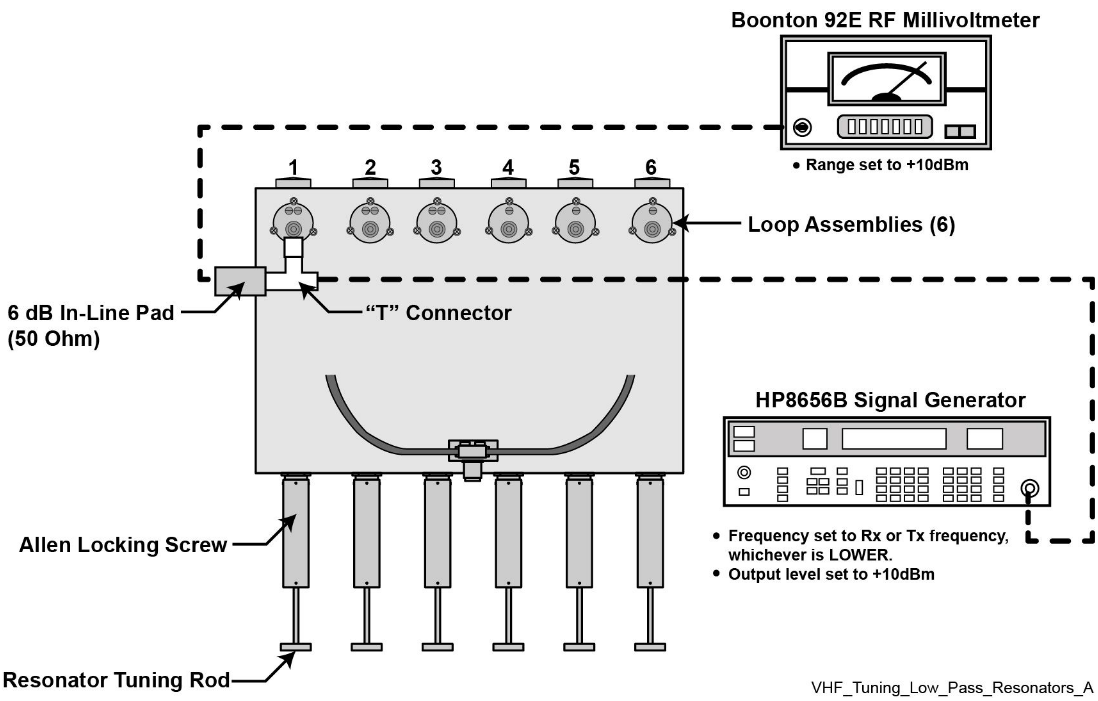
Tuning VHF Duplexer Low Pass Resonators

Perform the tasks in Procedure 5-10.

Procedure 5-10 How To Tune VHF Duplexer Low Pass Resonators

1	Set up test equipment as shown in Figure 5-4.
2	Push or pull tuning rod for cavity #1 to obtain a **PEAK** reading on the millivoltmeter
3	Use the Allen wrench and tighten locking screw.
4	Repeat steps 2 & 3 for cavities 2 and 3.

Figure 5-4 Test Equipment Set Up for Tuning VHF Duplexer Low Pass Resonator



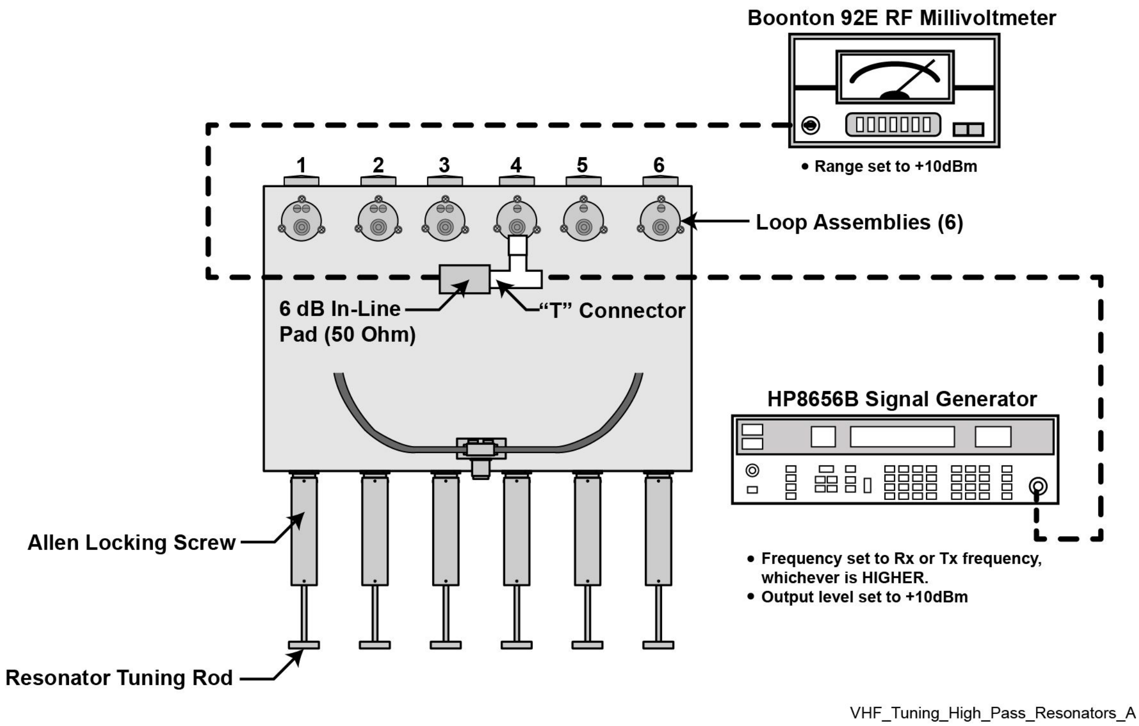
Tuning VHF Duplexer High Pass Resonators

Perform the tasks in Procedure 5-11.

Procedure 5-11 How To Tune VHF Duplexer High Pass Resonators

1	Set up test equipment as shown in Figure 5-5.
2	Push or pull tuning rod for cavity #4 to obtain a **PEAK** reading on the millivoltmeter
3	Use the Allen wrench and tighten locking screw.
4	Repeat steps 2 & 3 for cavities 5 and 6.

Figure 5-5 Test Equipment Set Up for Tuning VHF Duplexer High Pass Resonator



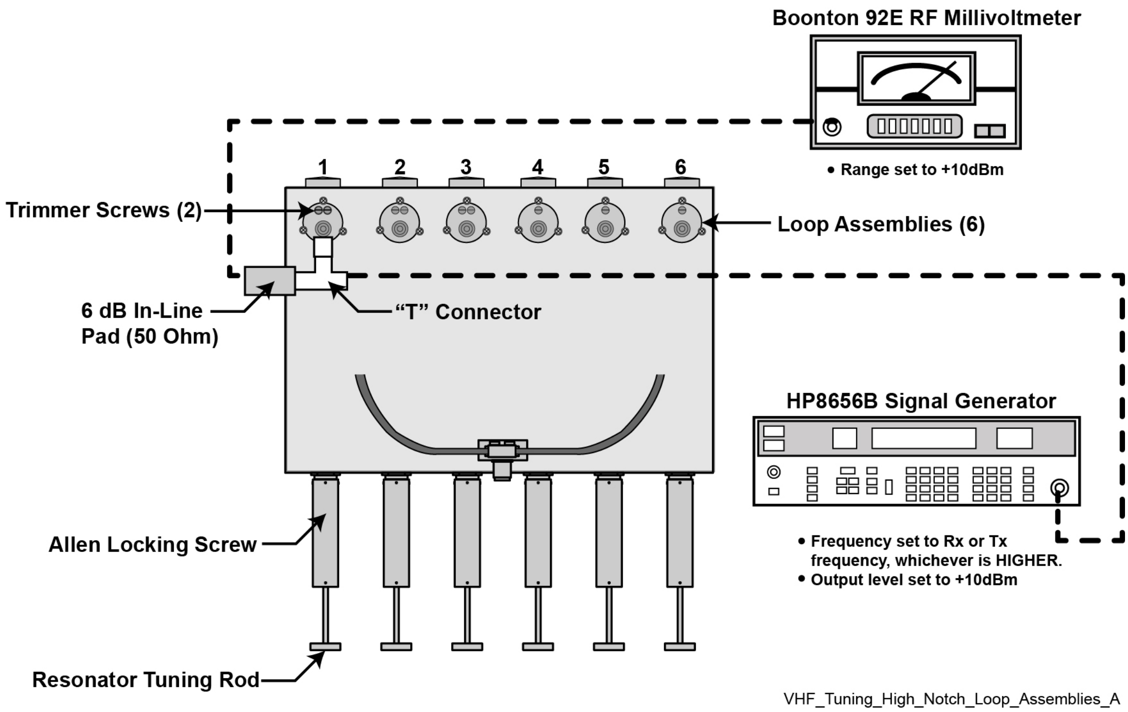
Tuning VHF Duplexer High Notch Loop Assemblies

Perform the tasks in Procedure 5-12.

Procedure 5-12 How To Tune VHF Duplexer High Notch Loop Assemblies

1	Set up test equipment as shown in Figure 5-6.
2	Use the tuning tool to adjust trimmer screws for cavity # 1 to obtain **minimum** reading on millivoltmeter. (Adjust trimmer screws equally to obtain minimum. Reduce the range on the millivoltmeter as necessary to reach true minimum reading.)
3	Repeat steps 1 & 2 for cavities 2 and 3.

Figure 5-6 Test Equipment Set Up for Tuning VHF Duplexer High Notch Loop Assemblies



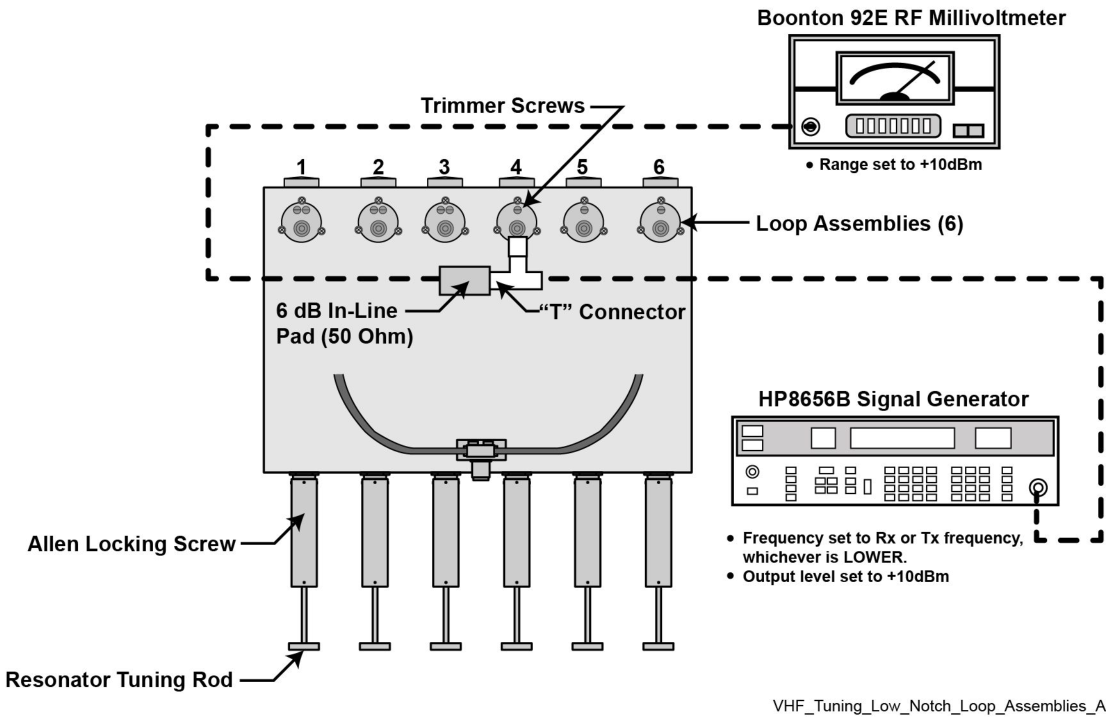
Tuning VHF Duplexer Low Notch Loop Assemblies

Perform the tasks in Procedure 5-13.

Procedure 5-13 How To Tune VHF Duplexer Low Notch Loop Assemblies

1	Set up test equipment as shown in Figure 5-7.
2	Use the tuning tool to adjust trimmer screws for cavity # 4 to obtain **minimum** reading on millivoltmeter. (Adjust trimmer screw to obtain minimum. Reduce the range on the millivoltmeter as necessary to reach true minimum reading.)
3	Repeat steps 1 & 2 for cavities 5 and 6.

Figure 5-7 Test Equipment Set Up for Tuning VHF Duplexer Low Notch Loop Assemblies



Verifying VHF Duplexer Insertion Loss

Perform the tasks in Procedure 5-14.

Procedure 5-14 How To Verify VHF Duplexer Insertion Loss

1	Connect test equipment as shown in Figure 5-8.
2	Observe and note the level in dBm as shown on the millivoltmeter.
3	Connect the duplexer cable assembly and test equipment to the duplexer as shown in Figure 5-9.
4	Observe and note the level in dBm as shown on the millivoltmeter.
5	Subtract the absolute number noted in step 2 from the number noted in step 4. The difference should be less than 1.3 dB to meet specification for Insertion Loss.
6	Repeat steps 1 through 5 for Low-Pass/High-Notch cavities with the following exceptions: **1.** Set the service monitor to Rx or Tx frequency, whichever is **LOWER** **2.** Connect service monitor to Low Pass duplexer input (cavity # 1) **3.** Connect terminator to cavity #6.

Figure 5-8 Verifying VHF Duplexer Insertion Loss — Connecting Test Equipment

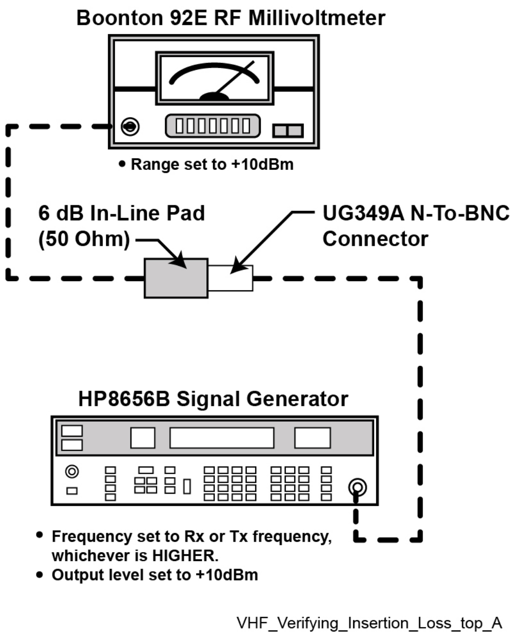
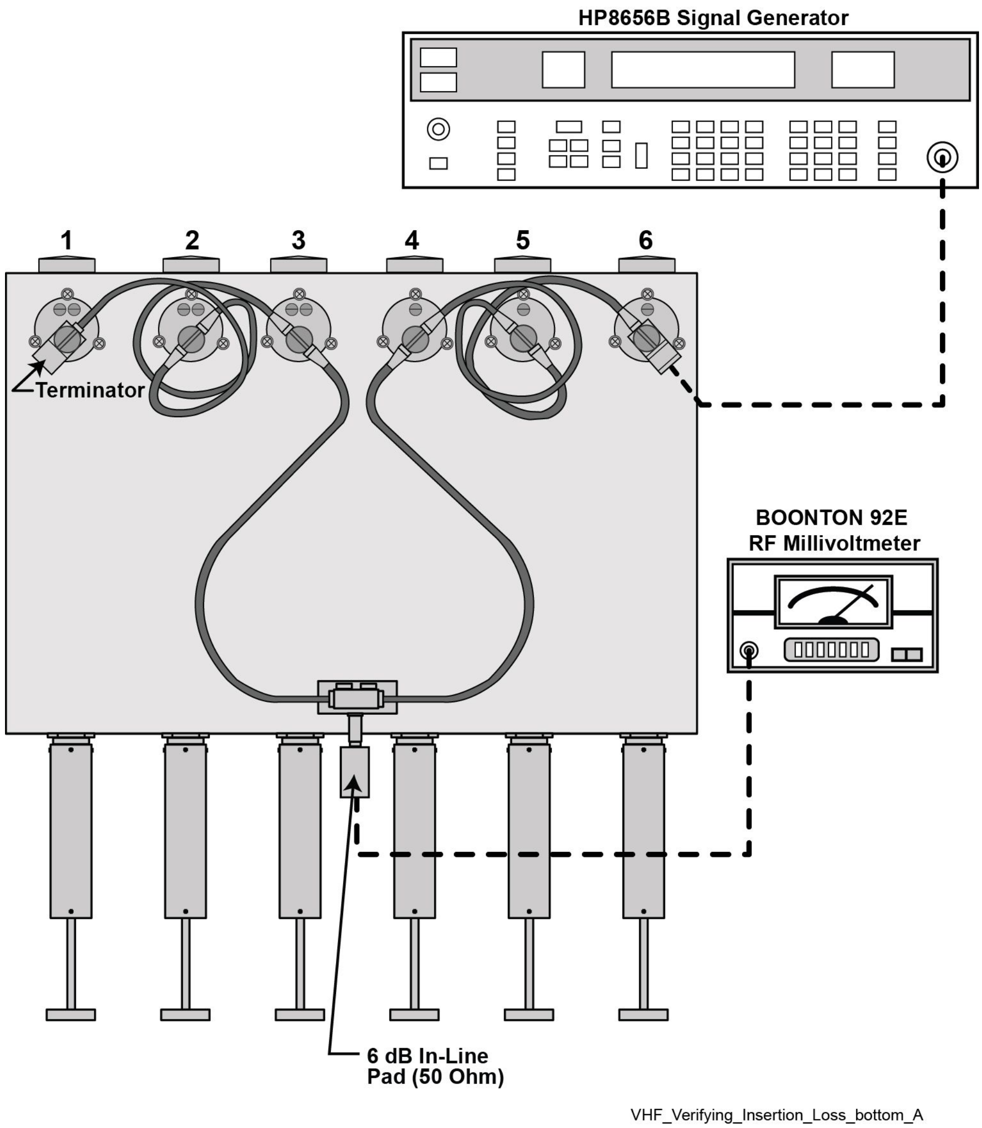


Figure 5-9 Verifying VHF Duplexer Insertion Loss — Connecting Duplexer Cable Assembly



Verifying VHF Duplexer Isolation

Perform the tasks in Procedure 5-15.

Procedure 5-15 How To Verify VHF Duplexer Isolation

1	Connect test equipment as shown in Figure 5-10.
2	Observe and note the level in dBm as shown on the service monitor.
3	Connect the test equipment to the duplexer as shown in Figure 5-11.

Procedure 5-15 How To Verify VHF Duplexer Isolation (Continued)

4	Observe and note the level in dBm as shown on the service monitor. (If no number is displayed, consider isolation to be greater than 105 dB, which exceeds the specification.)
5	Subtract the absolute number noted in step 4 from the number noted in step 2. The difference should be less than 75 dB to meet specification for Isolation.
6	Repeat steps 1 through 5 for Low-Pass/High-Notch cavities with the following exceptions: **1.** Set service monitor tor Rx or Tx frequency, whichever is **HIGHER** **2.** Connect service monitor to Low Pass duplexer input (cavity # 1) **3.** Connect terminator to cavity #6.

Figure 5-10 Verifying VHF Duplexer Isolation — Connecting Test Equipment

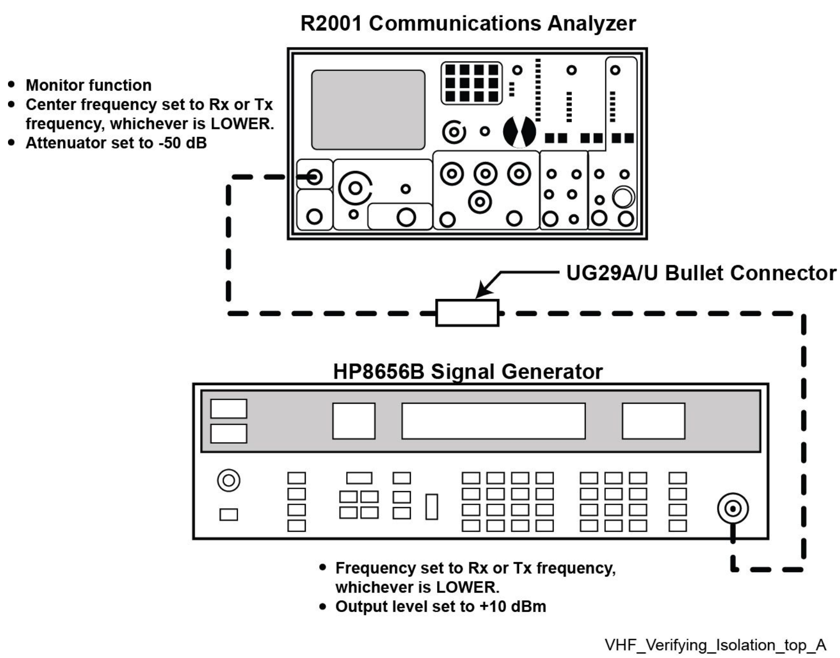
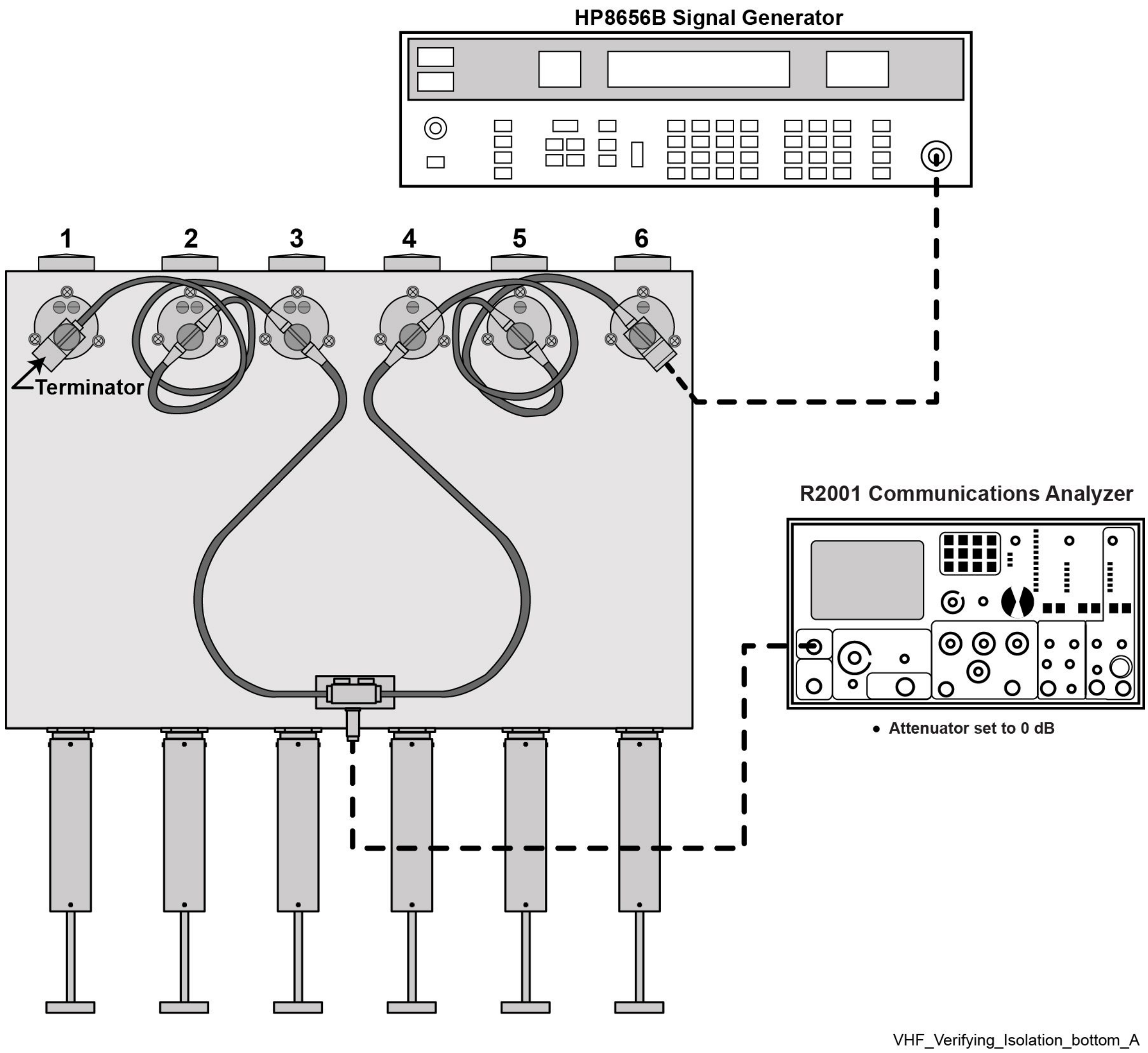


Figure 5-11 Verifying VHF Duplexer Isolation — Connecting Duplexer Cable Assembly



VHF Duplexer Post Tuning Checks

Perform the tasks in Procedure 5-16.

Procedure 5-16 How To Perform VHF Duplexer Post Tuning Checks

1	Make sure all locking screws are tight. Re-install dust covers on all trimmer capacitors.
2	Make sure all tuning rod locking screws (6) are tight.

Tuning a UHF Duplexer

The following procedures are most easily performed with the duplexer module removed from the rack or cabinet. Be sure to make note of the transmit and receive frequencies for the particular base radio before beginning.

If the duplexer module is tuned according to instructions and does not meet specifications for return loss, insertion loss, and/or isolation, you must return the duplexer for repair.

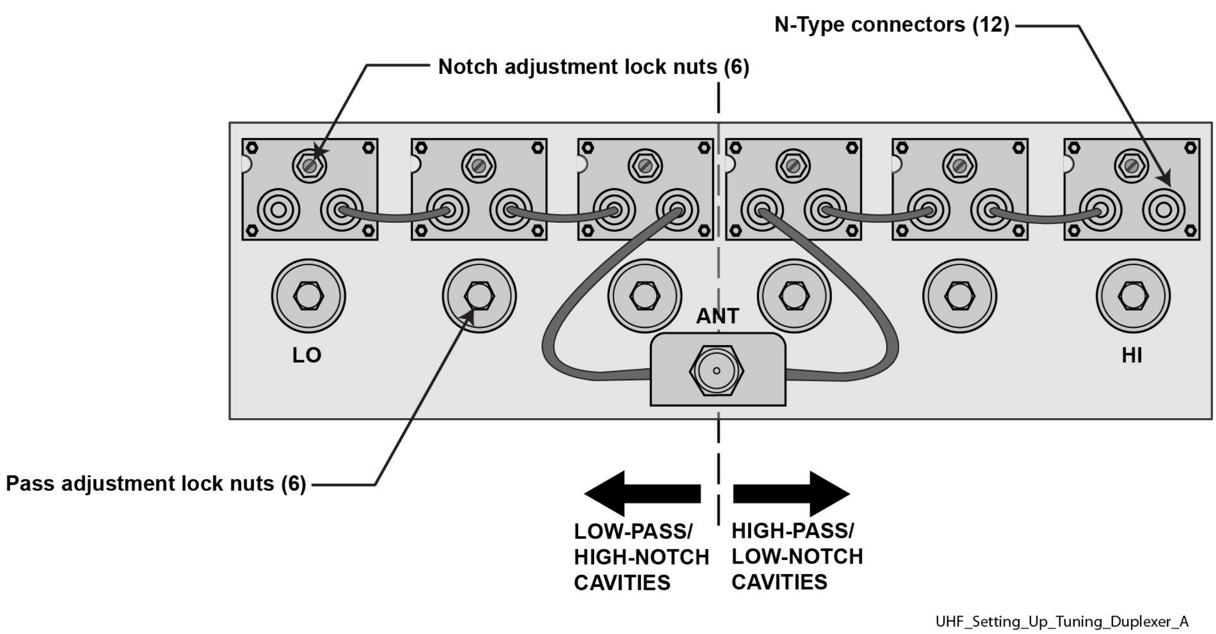
Setting Up for Tuning a UHF Duplexer

Perform the tasks in Procedure 5-17 prior to tuning the UHF duplexer module. See Figure 5-12.

Procedure 5-17 How To Setup Tuning the UHF Duplexer

1	Disconnect N-type connectors (12) and remove cables (6) from cavities.
2	For each cavity (6), use open end wrench and loosen locknuts (2 per cavity).

Figure 5-12 UHF Duplexer Tuning Setup



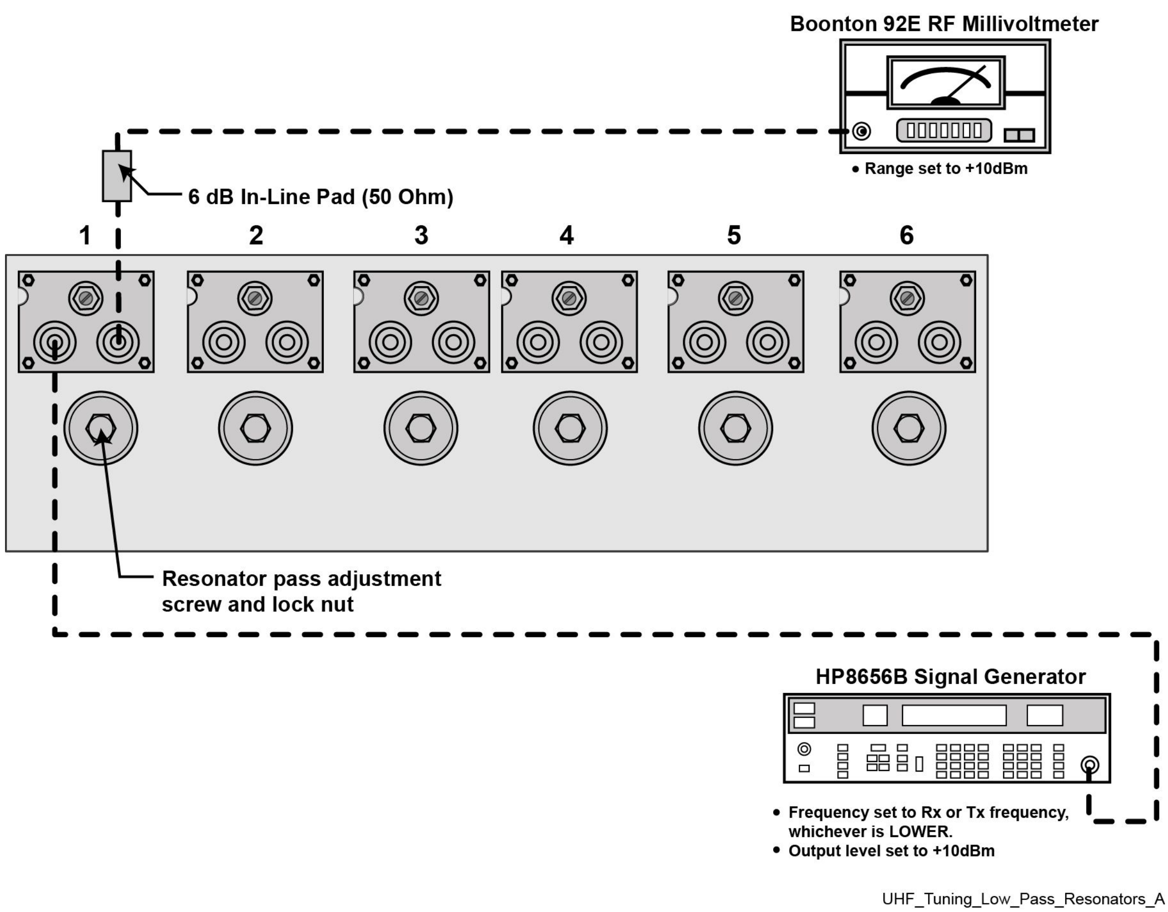
Tuning UHF Duplexer Low Pass Resonators

Perform the tasks in Procedure 5-18.

Procedure 5-18 How To Tune UHF Duplexer Low Pass Resonators

1	Set up test equipment as shown in Figure 5-13.
2	Use nut driver to adjust pass adjustment screw for cavity # 1 to obtain a **PEAK** reading on the millivoltmeter.
3	Use open end wrench and tighten lock nut *carefully*, making sure pass adjustment screw does not shift position.
4	Repeat steps 2 & 3 for cavities 2 and 3.

Figure 5-13 Test Equipment Set Up for Tuning UHF Duplexer Low Pass Resonator



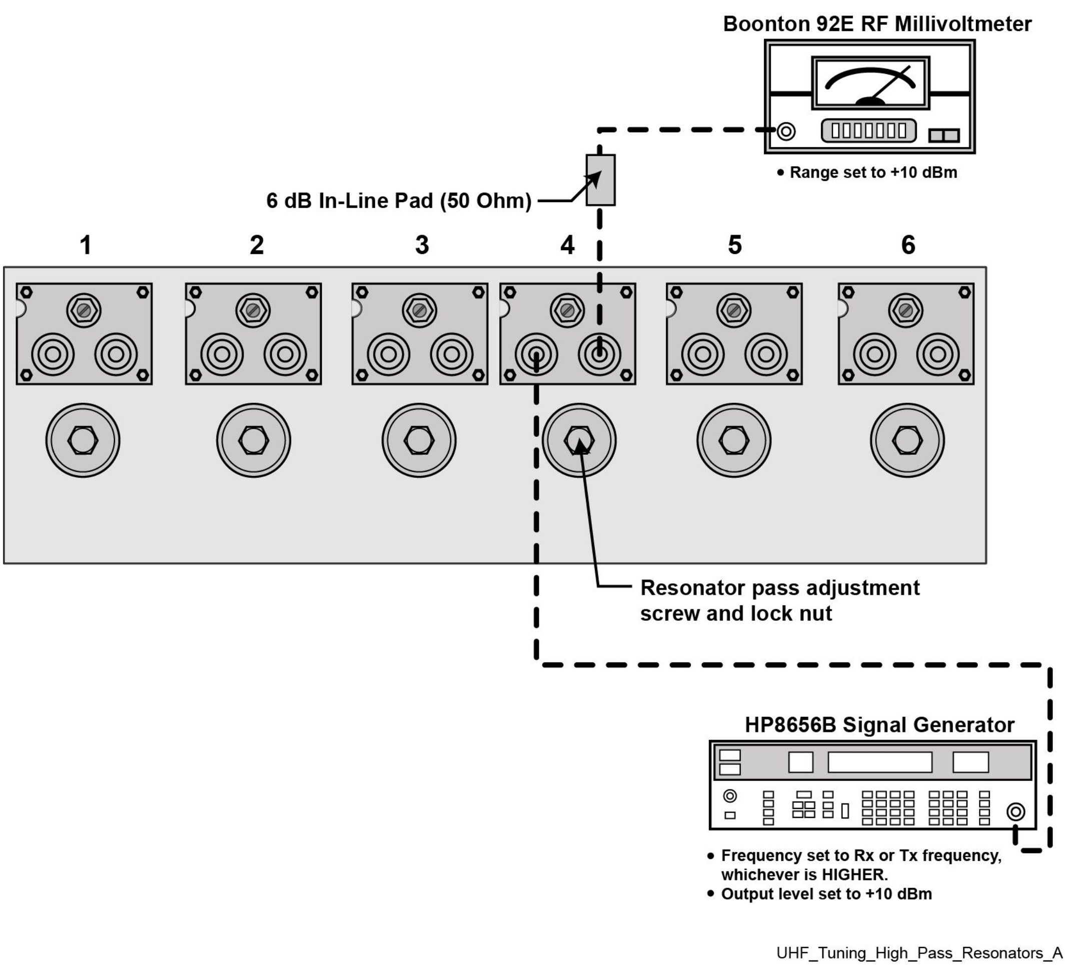
Tuning UHF Duplexer High Pass Resonators

Perform the tasks in Procedure 5-19.

Procedure 5-19 How To Tune UHF Duplexer High Pass Resonators

1	Set up test equipment as shown in Figure 5-14.
2	Use nut driver to adjust pass adjustment screw for cavity #4 to obtain a **PEAK** reading on the millivoltmeter.
3	Use open end wrench and tighten lock nut *carefully*, making sure pass adjustment screw does not shift position.
4	Repeat steps 2 & 3 for cavities 5 and 6.

Figure 5-14 Test Equipment Set Up for Tuning UHF Duplexer High Pass Resonator



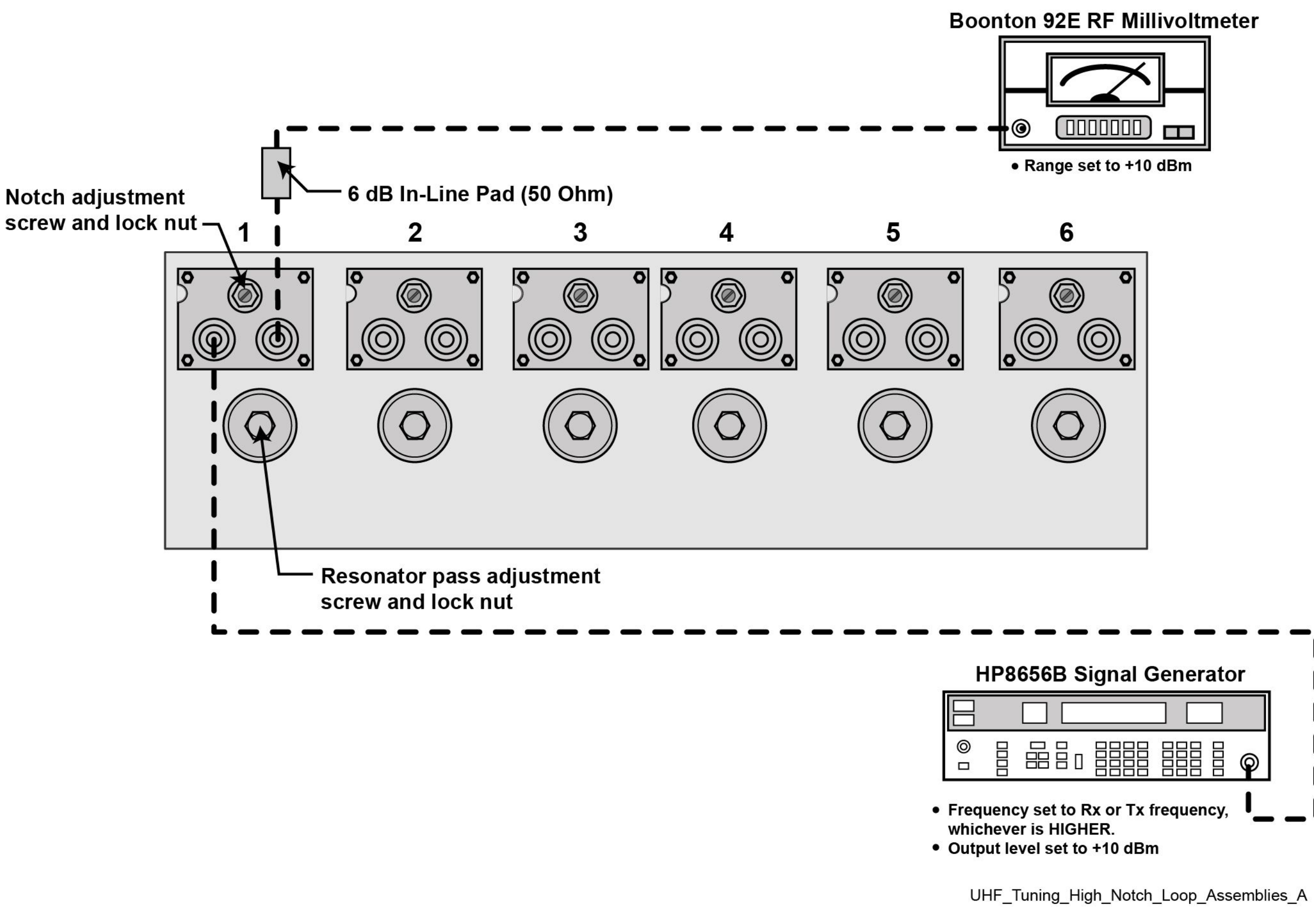
Tuning UHF Duplexer High Notch Loop Assemblies

Perform the tasks in Procedure 5-20.

Procedure 5-20 How To Tune UHF Duplexer High Notch Loop Assemblies

1	Set up test equipment as shown in Figure 5-15.
2	Use screwdriver to adjust notch adjustment screw for cavity # 1 to obtain a **minimum** reading on the millivoltmeter. (Reduce the range on the millivoltmeter as necessary to reach true minimum reading.)
3	Use open end wrench and tighten lock nut *carefully*, making sure notch adjustment screw does not shift position.
4	Repeat steps 2 & 3 for cavities 2 and 3.

Figure 5-15 Test Equipment Set Up for Tuning UHF Duplexer High Notch Loop Assemblies



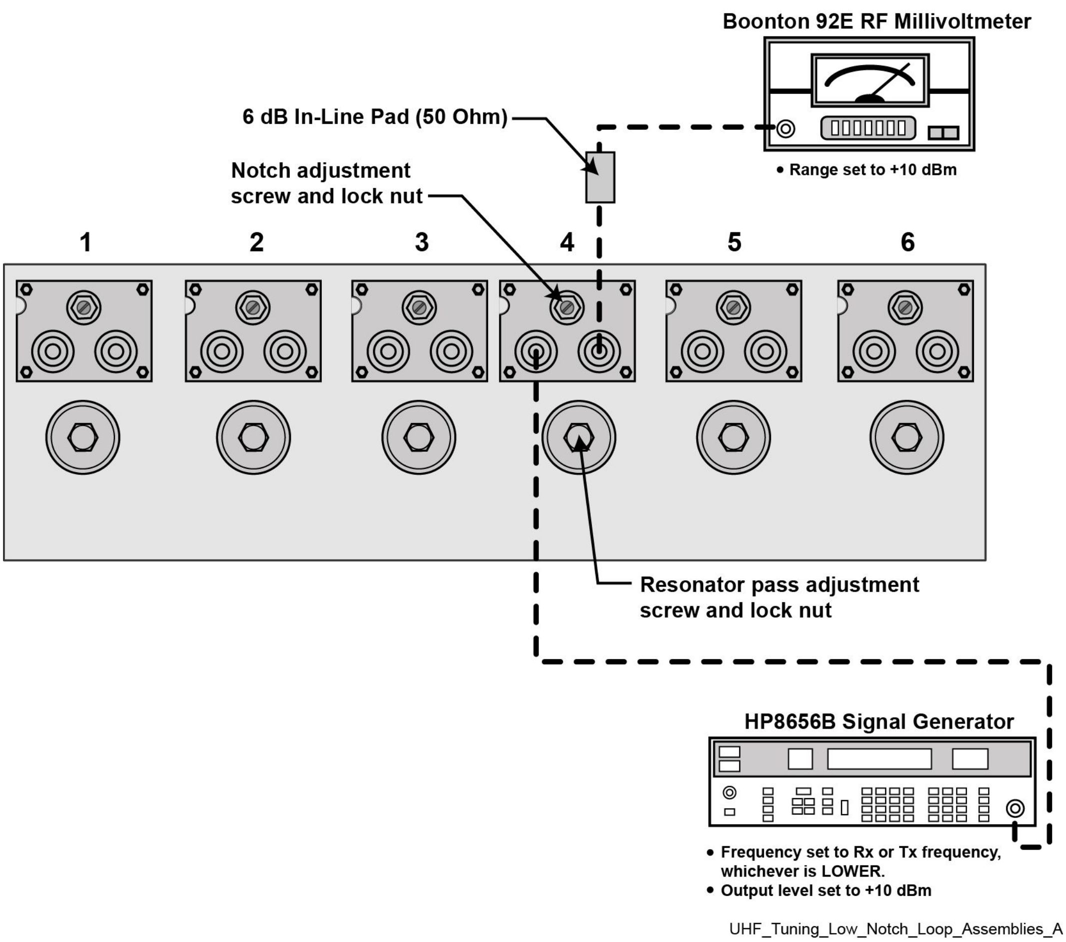
Tuning UHF Duplexer Low Notch Loop Assemblies

Perform the tasks in Procedure 5-21.

Procedure 5-21 How To Tune UHF Duplexer Low Notch Loop Assemblies

1	Set up test equipment as shown in Figure xx.
2	Use screwdriver to adjust notch adjustment screw for cavity #4 to obtain a **minimum** reading on the millivortmeter. (Reduce the range on the millivoltmeter as necessary to reach true minimum reading.)
3	Use open end wrench and tighten lock nut *carefully*, making sure notch adjustment screw does not shift position.
4	Repeat steps 2 & 3 for cavities 5 and 6.

Figure 5-16 Test Equipment Set Up for Tuning UHF Duplexer Low Notch Loop Assemblies



Verifying UHF Duplexer Insertion Loss

Perform the tasks in Procedure 5-22.

Procedure 5-22 How To Verify UHF Duplexer Insertion Loss

1	Connect test equipment as shown in Figure 5-17.
2	Observe and note the level in dBm as shown on the millivoltmeter.
3	Connect the duplexer cable assembly and test equipment to the duplexer as shown in Figure 5-18.
4	Observe and note the level in dBm as shown on the millivoltmeter.
5	Subtract the absolute number noted in step 2 from the number noted in step 4. The difference should be less than 1.3 dB to meet specification for Insertion Loss.
6	Repeat steps 1 through 5 for Low-Pass/High-Notch cavities with the following exceptions: **1.** Set service monitor to Rx or Tx frequency, whichever is **LOWER** **2.** Connect millivoltmeter to Low Pass duplexer input (cavity # 1) **3.** Connect terminator to cavity #6.

Figure 5-17 Verifying UHF Duplexer Insertion Loss — Connecting Test Equipment

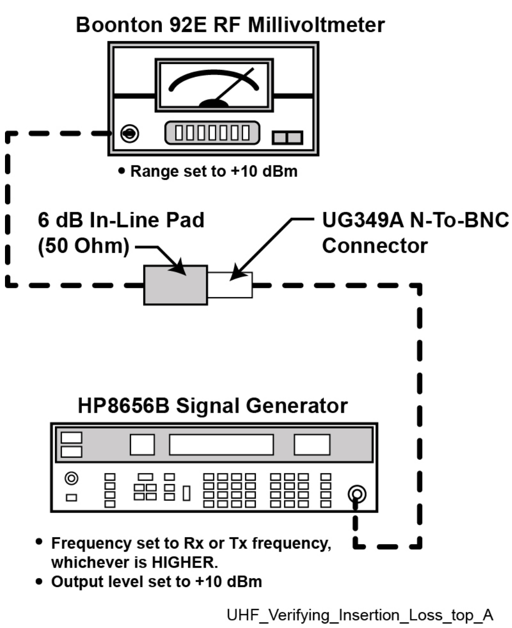
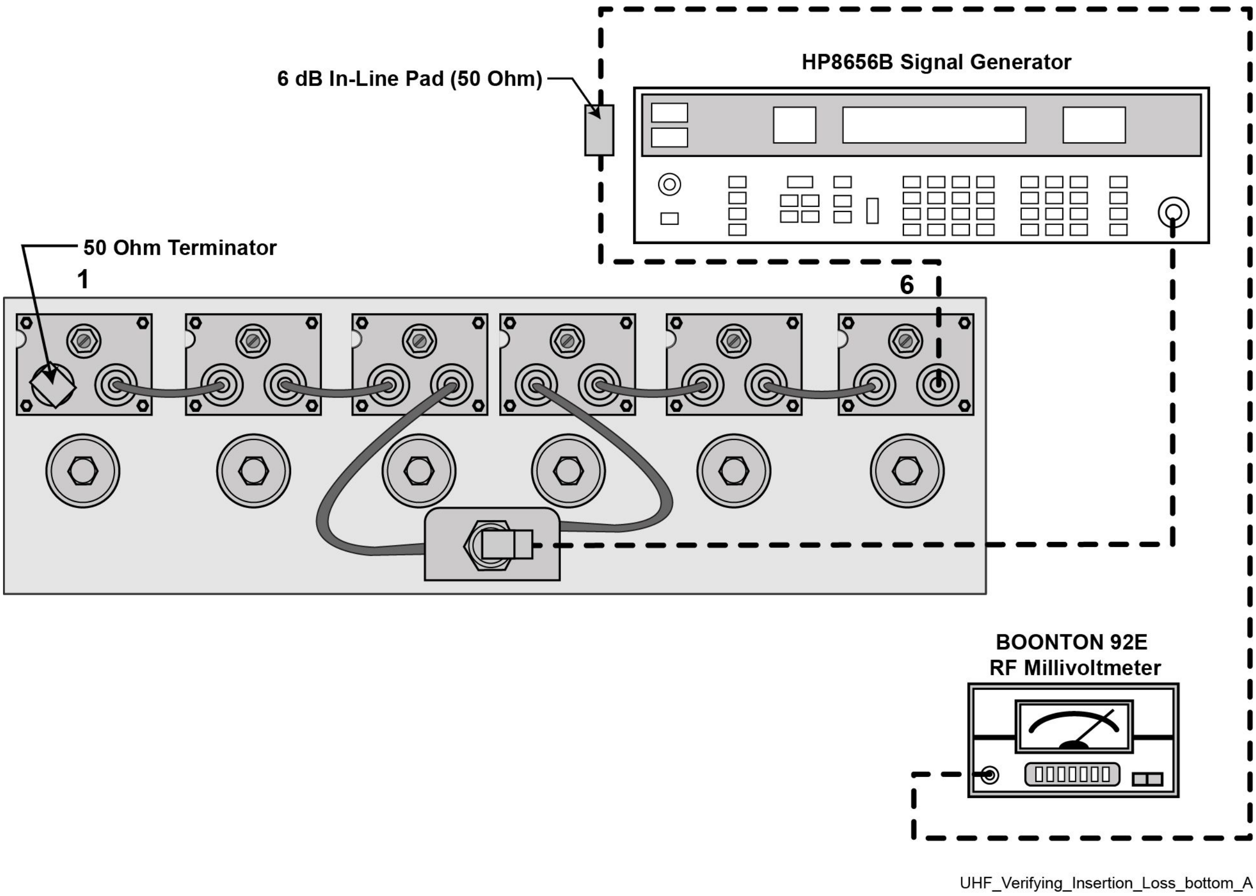


Figure 5-18 Verify UHF Duplexer Insertion Loss — Connecting Duplexer Cable Assembly



Verifying UHF Duplexer Isolation

Perform the tasks in Procedure 5-23.

Procedure 5-23 How To Verify UHF Duplexer Isolation

1	Connect test equipment as shown in Figure 5-19.
2	Observe and note the level in dBm as shown on the service monitor.
3	Connect the test equipment to the duplexer as shown in Figure 5-20.
4	Observe and note the level in dBm as shown on the service monitor. (If no number is displayed, consider isolation to be greater than 105 dB, which exceeds the specification.)
5	Subtract the absolute number noted in step 4 from the number noted in step 2. The difference should be higher than 100 dB to meet specification for Isolation.
6	Repeat steps 1 through 5 for Low-Pass/High-Notch cavities with the following exceptions: **1.** Set service monitor tor Rx or Tx frequency, whichever is **HIGHER** **2.** Connect service monitor to Low Pass duplexer input (cavity # 1) **3.** Connect terminator to cavity #6.

Figure 5-19 Verifying UHF Duplexer Isolation — Connecting Test Equipment

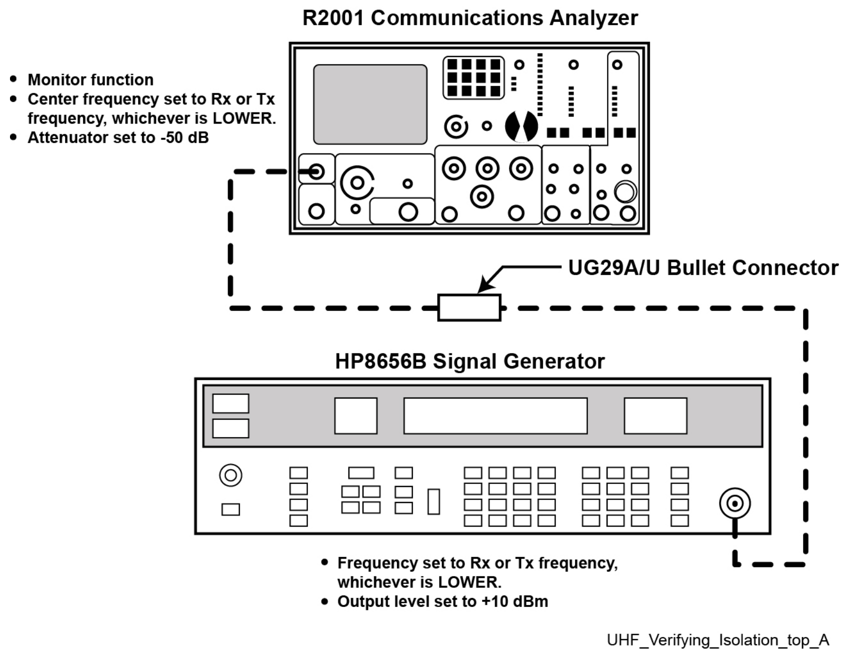
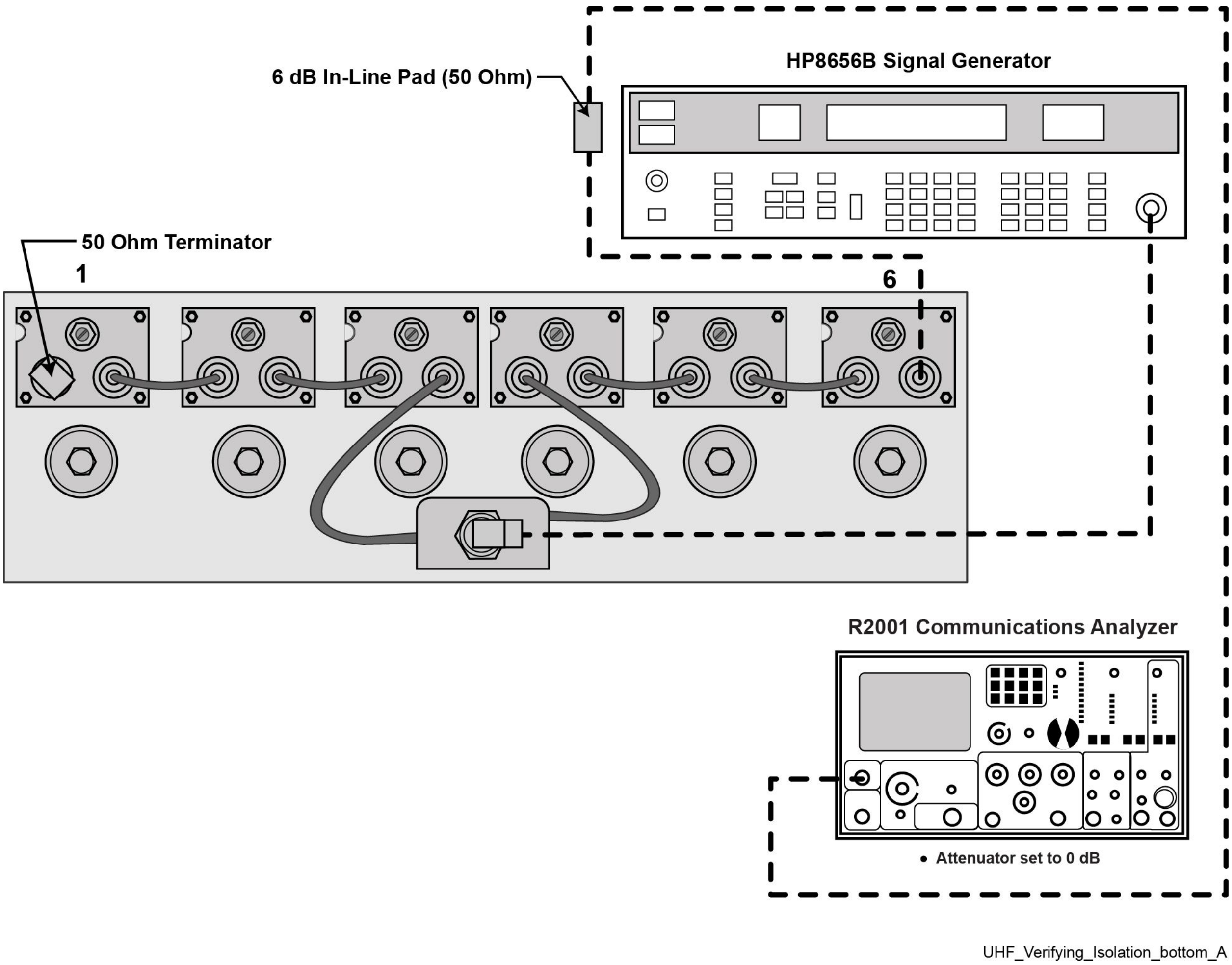


Figure 5-20 Verifying UHF Duplexer Isolation — Connecting Duplexer Cable Assembly



UHF Duplexer Post Tuning Checks

Perform the tasks in Procedure 5-24.

Procedure 5-24 How To Perform UHF Duplexer Post Tuning Checks

1	Make sure all notch adjustment lock nuts (6) are tight.
2	Make sure all pass adjustment lock nuts (6) are tight.

Testing the GTR 8000 Base Radio/GPW 8000 Receiver Performance with a Service Monitor for Integrated Voice & Data

The service monitor is a tool used to test and measure the transmitter and receiver characteristics of the base radio. The Service Monitor may be connected to a base radio to perform tests and measurements designed to determine whether the equipment is operating within specifications.

The sections that follow contain procedures that are performed when you first set up your system and can also be scheduled on a regular basis as part of the maintenance policies of your organization. Topics covered include:

- "Deviation Standards (Digital Operation)" on page 5-31
- "Monitoring the Power Supply Module" on page 5-32
- "Verifying Receiver Performance (Digital Operation)" on page 5-33
- "Verifying Receiver Performance (Analog Operation)" on page 5-34
- "Checking Receiver Sensitivity (Self-test Method) (IV&D)" on page 5-36
- "Monitoring the Transmitter Metering Points" on page 5-37
- "Verifying Transmitter Performance (Digital Operation)" on page 5-38
- "Verifying Transmitter Performance (Analog Operation)" on page 5-41

Deviation Standards (Digital Operation)

Table 5-2 lists the deviation standards for each ASTRO® 25 system test pattern.

NOTE

The specifications in this table allow a spread of ± 10%. However, the accuracy of the service monitor needs to be taken into account. Since the accuracy of the service monitor is only ± 5%, the allowable spread in the measured deviation should only be ± 5% and not ± 10%.

Table 5-2 Deviation Standards for ASTRO® 25 System Test Patterns

Signal	Minimum Deviation	Nominal Deviation	Maximum Deviation
low signal deviation	0.84 kHz	0.93 kHz	1.02 kHz
sow signal wide pulse deviation	undetermined	1.00 kHz	undetermined
standard deviation	2.55 kHz	2.83 kHz	3.11 kHz
standard wide pulse deviation	undetermined	3.00 kHz	undetermined

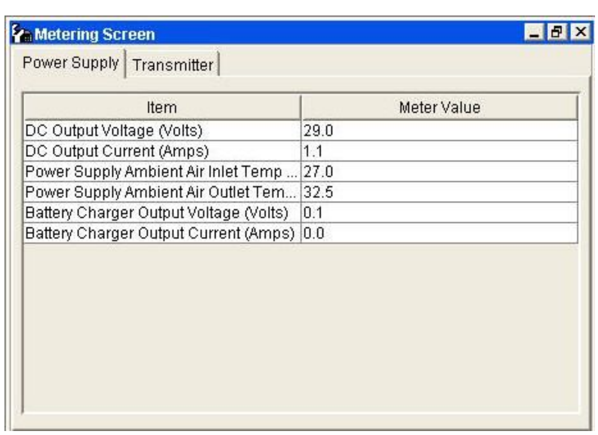
Table 5-2 Deviation Standards for ASTRO® 25 System Test Patterns (Continued)

Signal	Minimum Deviation	Nominal Deviation	Maximum Deviation
V.52 deviation	2.91 kHz	3.23 kHz	3.55 kHz
V.52 wide pulse deviation	undetermined	3.00 kHz	undetermined
C4FM deviation	2.91 kHz	3.23 kHz	3.55 kHz
C4FM wide pulse deviation	undetermined	3.00 kHz	undetermined
GPS test pattern - simulcast	undetermined	3.00 kHz	undetermined
ASTRO® 25 system voice	3.24 kHz	3.60 kHz	3.96 kHz
ASTRO® 25 system wide pulse	undetermined	3.00 kHz	undetermined

Monitoring the Power Supply Module

Procedure 5-25 explains how to monitor the power supply module in the base radio.

Procedure 5-25 How to Monitor the Power Supply Module

<table>
<tr><td>1</td><td>Connect to the transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.</td></tr>
<tr><td>2</td><td>From the Service menu, select Metering Screens.
Result: The Metering Screen window opens (Figure 5-21).</td></tr>
<tr><td>3</td><td>Select the Power Supply tab.
Result: The Power Supply tab appears (Figure 5-21).
Figure 5-21 Power Supply Tab

</td></tr>
<tr><td>4</td><td>Click the Close button in the upper right corner of the window to close it.</td></tr>
</table>

Verifying Receiver Performance (Digital Operation)

Procedure 5-26 explains how to verify receiver performance by measuring the Bit Error Rate (BER) and RSSI for digital operation.

Procedure 5-26 How to Verify Receiver Performance (Digital Operation)

1	Connect to the transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
2	From the **Service** menu, select the **Test and Measurement Screen**.
3	Select the **ASTRO BER & RSSI Report** tab.
4	Make the following connections to the base radio: **1.** Disconnect the BNC antenna cable (or N connector if preselector is present) from the Receive Antenna Port. **2.** Connect the service monitor GEN port to the base radio's Antenna Port.
5	**1.** Set up the service monitor: **a.** Modulation to Project 25 (C4FM) (with a Standard 1011 or 1031) test pattern. **b.** Set the service analyzer to generate at the receive frequency. **c.** Set the RF level an initial value of –50 dBm.
6	Set up the test in CSS: **1.** If the base radio is not already in service mode, click **Change to Service Mode**. **Result:** A confirmation dialog box appears. **2.** Click **OK**. **Result:** The base radio begins a reset sequence to change modes, which takes a few minutes. After the base radio resets, re-open the Test and Measurement Screen as described in step 2. **3.** Select **Project 25** from the Pattern Type field. **4.** Enter the number of required seconds from the **Sampling Period (sec)** list box. The time specifies the window over which the BER is calculated.

Procedure 5-26 How to Verify Receiver Performance (Digital Operation) (Continued)

7	Measure the BER and RSSI: **1.** Click **Start BER Measurement**. **Result:** The Test and Measurement Screen dialog box displays: ◦ BER results in percentage ◦ RSSI results expressed in dBm **NOTE** With the initial setting of the service monitor set for a carrier level of –50 dBm, you should expect a BER of 0.0 % and an RSSI level between –48 dBm and –52 dBm. Remember to compensate for the loss of the cable connecting the service monitor to the base radio. **NOTE** If the receiver is inhibited, RSSI will display a meaningless value. **2.** Click **Start Log** to create a log file for the BER and RSSI measurement. **Result:** The Log Save As window appears. **3.** Change the RF level and read the BER and RSSI again at the level appropriate for the base radio. The value should be less than 5%. See the specifications in Chapter 1 for the appropriate value. **4.** Key the transmitter in the base radio and readjust the generator output level until 5% BER is indicated on the service monitor. Record this level. **Result:** Less than 1 dB of degradation should occur due to the transmitters being keyed. **5.** Dekey the transmitter. **6.** Click **Stop BER Measurement** to stop the test.
8	If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.
9	Remove and restore the following connections to the base radio: **1.** Remove the service monitor GEN port connection from the base radio Antenna Port. **2.** Restore the Antenna connection to the Receive Antenna Port.

Verifying Receiver Performance (Analog Operation)

Procedure 5-27 explains how to verify receiver performance by measuring the receiver sensitivity (SINAD) for an analog base radio.

NOTE

This procedure uses an internal SINAD in the base radio. If a field technician chooses to use a service monitor as an external SINAD meter, see “SINAD Measurement Procedure (measured by Service Monitor)” within Base Radio Service Help -> Service Screens -> Alignment Screens -> Carrier Squelch Alignment Tab in the *CSS Online Help*.

Procedure 5-27 How to Verify Receiver Performance (Analog Operation)

1	Connect to the transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
2	From the **Service** menu, select **Alignment Screens**.
3	**1.** If the base radio is not already in service mode, click **Change to Service Mode**. **Result:** A confirmation dialog box appears. **2.** Click **OK**. **Result:** The base radio begins a reset sequence to change modes, which takes a few minutes. After the base radio resets, re-open the **Alignment Screen** as described in step 2.:
4	Select the **Carrier Squelch Alignment** tab.
5	Make the following connections to the base radio: **1.** Disconnect the BNC antenna cable or N connector if a preselector is present from the Receive Antenna Port. **2.** Connect the service monitor GEN port to the base radio's Antenna Port with a BNC connector.
6	Set up the service monitor. **1.** For 25 kHz channels, set the modulation to 1 kHz tone at 3 kHz deviation. **2.** For 12.5 kHz channels, set the modulation to 1 kHz tone at 1.5 kHz deviation. **3.** Set the service monitor to generate at the receive frequency. **4.** Set the RF level an initial value of –80 dBm.
7	To measure 25 kHz channel SINAD, press the 25 kHz button. To measure 12.5 kHz channel SINAD, press the 12.5 kHz button.
8	Select the **SINAD measurement** box.
9	Click **Start SINAD Measurement**. **Result:** The SINAD Measurement Value box displays wait and after 10 seconds starts to display the SINAD results in dB. With the initial setting of the service monitor set for a carrier level of –80 dBm, expect a SINAD of >26 dB. Remember to compensate for the loss of the cable connecting the service monitor to the base radio. If the receiver is inhibited, SINAD will display a meaningless value.

Procedure 5-27 How to Verify Receiver Performance (Analog Operation) (Continued)

10	Change the service monitor's RF level and read the SINAD again until the value is 12 dB. **NOTE** When the SINAD value is close to 12 dB, wait 10 seconds after changing the RF signal generator level. The base radio needs 10 seconds to stabilize the SINAD measurement. Remember to compensate for the loss of the cable connecting the service monitor to the base radio.
11	Record the signal generator RF level. Compare this value to the sensitivity specifications. See the specifications in Chapter 1 for the appropriate value. **1.** Key the transmitter in the base radio and readjust the generator output level until 12 dB SINAD is indicated on the service monitor. Record this level. **Result:** Less than 1 dB of degradation should occur due to the transmitters being keyed. **2.** Dekey the transmitter.
12	Click the **Stop SINAD measurement** button to stop the measurement.
13	Uncheck the **SINAD measurement** box.
14	If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.
15	Remove and restore the following connections to the base radio: **1.** Remove the service monitor GEN port connection from the base radio Antenna Port. **2.** Restore the Antenna connection to the Receive Antenna Port.

Checking Receiver Sensitivity (Self-test Method) (IV&D)

Procedure 5-28 explains how to check the receiver sensitivity for the station without any test equipment. The receiver uses a factory calibrated low-level noise source at the receiver input to check performance. This procedure can be performed remotely.

Procedure 5-28 How to Check the Receiver Sensitivity (Self-test Method) (IV&D)

1	Connect to the base radio's transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
2	From the **Service** menu, select **Test and Measurement Screen** and select the **ASTRO BER & RSSI Report** tab.

Procedure 5-28 How to Check the Receiver Sensitivity (Self-test Method) (IV&D) (Continued)

3	Place the base radio into service mode: **1.** If the base radio is not already is service mode, click **Change to Service Mode**. **Result:** A confirmation dialog box appears. **2.** Click **OK**. **Result:** The base radio begins a reset sequence to change modes, which takes a few minutes. **3.** After the base radio resets, re-open the Test and Measurement Screen dialog box as described in step 2.
4	Select **Start Receiver Test**. **Result:** A confirmation dialog box appears indicating test's progress. After a few seconds, the test will conclude with a pass or fail message.
5	Click **OK**.
6	If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.

Monitoring the Transmitter Metering Points

Procedure 5-29 explains how to monitor the transmitter metering points in the base radio.

Procedure 5-29 How to Monitor the Transmitter Metering Points

1	Connect to the base radio's transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
2	From the **Service** menu, select **Metering Screens**. **Result:** The Metering Screen dialog box opens.
3	Click **Transmitter Test** to briefly key up the transmitter. **Result:** The status bar on the window confirms if the transmitter is operating properly or it has failed. The Current column displays the values read for the following: **NOTE** When the base radio is transmitting, the VSWR field on the screen will display a value of 1 or greater; when the base radio is not keyed, 1 will be displayed.

Item	Measures
Current Measured Forward Power (Watts)	Forward power of the base radio

Procedure 5-29 How to Monitor the Transmitter Metering Points (Continued)

	Current Measured Reflected Power (Watts)	Reflected power of the base radio
	Current Measured VSWR	Voltage Standing Wave Ratio (VSWR) of the base radio
	The following reading are for a conventional base radio:	
	Item	**Measures**
	Current Stored Forward Power (Watts)	Forward power of the base radio at the last keyup
	Current Stored Reflected Power (Watts)	Reflected power of the base radio at the last keyup
	Current Stored VSWR	Voltage Standing Wave Ratio (VSWR) of the base radio at the last keyup

Verifying Transmitter Performance (Digital Operation)

To verify the base radio transmitter meets the ASTRO® 25 system standards, you should force the base radio to transmit a V.52 standard test pattern. Procedure 5-30 explains how to test the transmitter signaling patterns.

Procedure 5-30 How to Verify Transmitter Performance (Digital Operation)

1	Connect to the base radio's transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
2	From the **Service** menu: **1.** Select **Test and Measurement Screen**. **2.** Select the **ASTRO Test Pattern** tab.
3	If the radio is not already in service mode, click **Change to Service Mode**. **Result:** A confirmation dialog box appears.
4	Click **OK**. **Result:** The base radio goes through a reset sequence to change modes. This takes a few minutes. After the station resets, re-open the Test and Measurement Screen, as described in step 2.

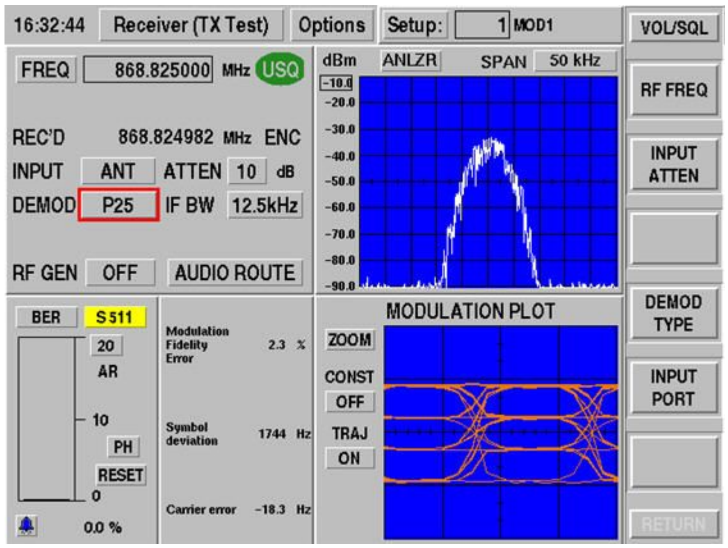
Procedure 5-30 How to Verify Transmitter Performance (Digital Operation) (Continued)

5	Connect the service monitor to the base radio: **1.** Remove the N-Type connector from the Transmitter Antenna Port. **2.** Connect an N-to-N cable from the Transmitter Antenna Port to the T/R port of the service monitor **3.** Make the following settings on the service analyzer: ◦ Click the **Receiver (TX Test)** button. ◦ Enter the frequency to match that of the base radio TX channel selected. ◦ Click the **INPUT PORT** button and set to T/R. ◦ Click the **ATTEN** button and set to 20 dB. ◦ Click the **DEMOD** button and set to P25. ◦ Click the **IF BW** button and set to 12.5 kHz ◦ Click the **RF GEN** button to turn OFF the Signal Generator Output. **4.** Click the **Options** button. Enable and make the following selections in the Spectrum Analyzer, EVM Data, Power Meter, and Modulation Plot, as follows: ◦ Expand the Power Meter and set to **AR** (Autorange). If necessary, change to 0. Press **Return**. Verify that Cable Loss is 0. If cable loss is anticipated, expand the Power Meter and enter the cable loss factor. ◦ Set the RF Error Meters to **AR** (Autorange). ◦ Set the modulation Meter to **AR** (Autorange).
6	Set up the test in CSS: Select **V.52** in the **Pattern Type** field.

Procedure 5-30 How to Verify Transmitter Performance (Digital Operation) (Continued)

<table>
<tr><td>7</td><td>Click Start Pattern Transmission. See Figure 5-22.

Figure 5-22 Configuration for Modulation Fidelity Measurement (Aeroflex 2975 Series Service Monitor)



Result: The service monitor displays:

The test pattern on the modulation scope.
The amount of deviation of the carrier.
The Modulation Fidelity as a percentage.
The transmitter's carrier frequency error.
</td></tr>
<tr><td>8</td><td>Record the NAC, TGID, and SID readings from the P25 Uplink Data (in the Options menu) for use in digital Receiver Testing.</td></tr>
<tr><td>9</td><td>Click Stop Pattern Transmission to turn off the test tone.</td></tr>
<tr><td>10</td><td>Disconnect the service monitor and reconnect the transmit antenna.</td></tr>
<tr><td>11</td><td>If no further testing is needed, click Change to Normal Mode to return the base radio to normal operation.</td></tr>
</table>

Verifying Transmitter Performance (Analog Operation)

To verify the base radio transmitter meets the ASTRO® 25 system standards, you should force the base radio to transmit a V.52 standard test pattern. Procedure 5-31 explains how to test the transmitter signaling patterns.

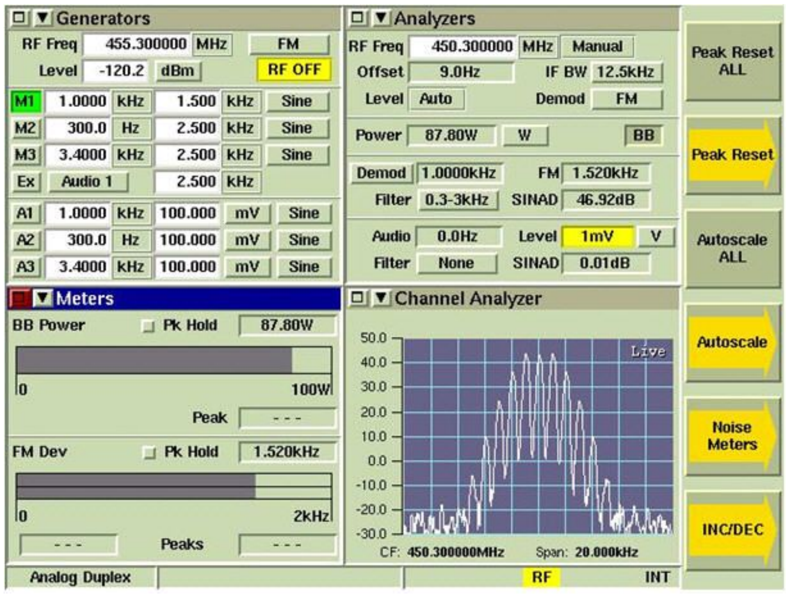
Procedure 5-31 How to Verify Transmitter Performance (Analog Operation)

1	Connect to the base radio's transceiver module in CSS through an Ethernet connection. See "Connecting Through an Ethernet Port Link" in the Configuration chapter.
2	From the **Service** menu: **1.** Select **Test and Measurement Screen**. **2.** Select the **ASTRO Test Pattern** tab.
3	If the radio is not already in service mode, click **Change to Service Mode**. **Result:** A confirmation dialog box appears.
4	Click **OK**. **Result:** The base radio goes through a reset sequence to change modes. This takes a few minutes. After the station resets, re-open the Test and Measurement Screen, as described in step 2.
5	Connect the service monitor to the base radio: **1.** Remove the N-Type connector from the Transmitter Antenna Port. **2.** Connect an N-to-N cable from the Transmitter Antenna Port to the T/R port of the service monitor **3.** Make the following settings on the service analyzer: ◦ Configure the service monitor for **Analog Duplex**. ◦ Enter the frequency to match that of the base radio TX channel selected. ◦ Click the **INPUT PORT** button and set to T/R. ◦ Click the **ATTEN** button and set to 20 dB. ◦ Click the **IF BW** button and set to 12.5 kHz for narrow channels. Select 25 kHz or 30 kHz for wide channels. ◦ Click the **DEMOD** button and set to FM. ◦ Click the **RF GEN** button to turn OFF the Signal Generator Output. ◦ For the power meter, select **W** and **BB** (Broadband). ◦ Select **0.3–3 kHz** for the audio filtering bandwidth.
6	Set up the test in CSS: Select **1 kHz Tone at 60% deviation without PL/DPL** from the Pattern to Transmit field.

Procedure 5-31 How to Verify Transmitter Performance (Analog Operation) (Continued)

7 Click **Start Pattern Transmission**. See Figure 5-23.

Figure 5-23 Configuration for Modulation Fidelity Measurement (Aeroflex 2975 Series Service Monitor)



Result: The service monitor displays:

- The transmit output power (make sure to account for any cable loss).
- The amount of FM deviation of the carrier.
- The Tx SINAD (measure of Tx distoration) in dB.
- The transmitter's carrier frequency error.

8 Click **Stop Pattern Transmission** to turn off the test tone.

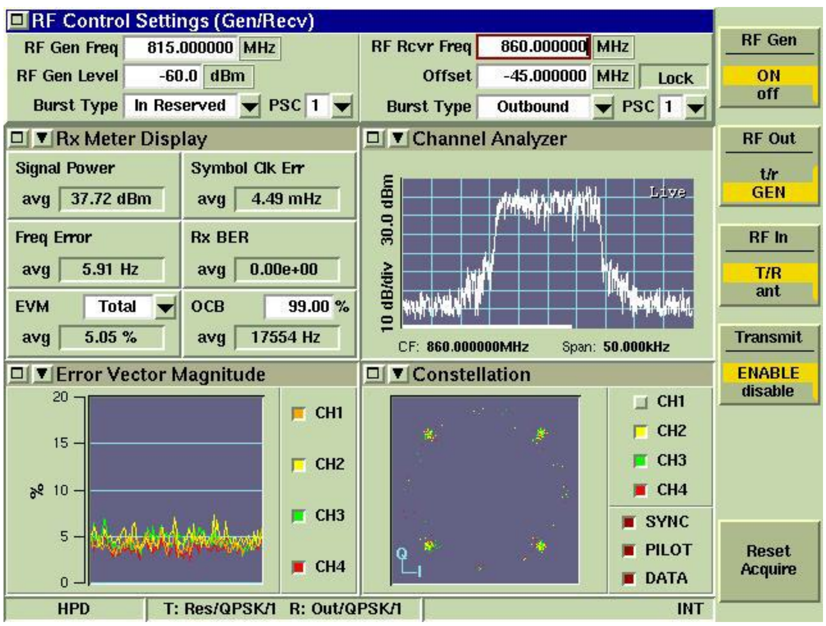
9 Disconnect the service monitor and reconnect the transmit antenna.

10 If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.

Testing the GTR 8000 Base Radio Performance with a Service Monitor for HPD

The HPD Service Monitor is a diagnostic tool that may be used with an HPD base radio or HPD modem to test and measure the transmitter and receiver characteristics. The HPD Service Monitor can generate HPD signaling and can provide diagnostic information for received signaling.

Figure 5-24 HPD Service Monitor – Test Screen (Aeroflex 3900 Series Service Monitor)



The HPD Service Monitor may be connected with an HPD base radio to perform the following diagnostic tests (for additional tests, see the HPD service monitor manual). These tests are designed to determine whether the equipment is operating within specification. Service may be required on an HPD base radio if it fails to meet specification.

- **Measure Transmit Power:** See Procedure 5-34.
- **Measure Frequency Accuracy:** See Procedure 5-34.
- **Measure Error Vector Magnitude (EVM) for Transmitter:** See Procedure 5-34.
- **Measure Receiver Sensitivity:** See Procedure 5-35.
- **Measure Bit Error Rate (BER) for Receiver:** See Procedure 5-35.
- **Checking Receiver Sensitivity:** See Procedure 5-36

For additional information about using the service monitor, see the HPD Service Monitor manual or online help (accessed through the **Help** button on the front of the service monitor).

Setting Up the HPD Service Monitor for Testing the Base Radio

This section covers the steps for setting up the HPD service monitor.

Procedure 5-32 How to Set Up the HPD Service Monitor for Testing the Base Radio

1	Plug a power cable into the AC port at the rear of the service monitor.
2	Connect a USB mouse to one of the two USB ports in the rear of the Service Monitor. **NOTE** The following procedures assume a USB mouse is connected. If not, for instructions to “click” or “select” you can use the **TAB** and arrow buttons on the front of the service monitor. For instructions to select a soft key on the right side of the screen, use the unlabeled buttons on the front of the service monitor, pressing the button located next to the soft key on the screen.
3	Configure the Speed/Duplex setting in the PC's Ethernet interface to 10 Mb Half Duplex.
4	Connect to the base radio's transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
5	From the **Service** menu, select **Test and Measurement Screen**. **Result:** The Test and Measurement Screen dialog box appears.
6	Disable the channel that is using the base radio you will test. **NOTE** The test procedures require the base radio's Rx and Tx cables to be connected to the HPD Service Monitor. Any calls present on the channel associated with the base radio will be dropped from that channel. It is recommended that you disable the channel before performing the test procedures, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager or the Configuration/Service Software (CSS) **Change to Service Mode** feature. If the radio is not already in service mode, click **Change to Service Mode**. **Result:** A confirmation dialog box appears.
7	Click **OK**. **Result:** The base radio goes through a reset sequence to change modes. This takes a few seconds. After the station resets, you must re-open the Test and Measurement Screen, as described in step 5.

Procedure 5-32 How to Set Up the HPD Service Monitor for Testing the Base Radio (Continued)

8	If you will be measuring the base radio's transmit signal, connect the Tx connector at the rear of the base radio to the T/R (Transmit/Receive) port on the front of the service monitor. (Both are N-type RF connectors.)
9	If you will be measuring the base radio's receive signal ("Measuring HPD BR Rx Sensitivity and Rx BER"), connect the Rx-A and Rx-B ports at the rear of the base radio to the GEN port on the front of the service monitor, using a splitter.
10	Press the green power button on the front of the Service Monitor.
11	If the Test Screen is not displayed (see Figure 5-24), press the **Test** button on the front of the service monitor.
12	Locate the specifications for the GTR 8000 Base Radio configuration you will be testing. See “GTR 8000 Base Radios Specifications” in the Description chapter.
13	If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.

Performing In-band Power Meter User Calibration

The Aeroflex 3900 series HPD service monitor has two forms of power measurement:

- Broadband, which is similar to the working of an in-line wattmeter.
- In-band, which is performed after the RF signal is down converted to baseband by a DSP.

If the HPD service monitor runs continuously, it requires periodic calibration. Re-calibration is required only if the User Calibration Threshold is exceeded. The service monitor displays a flag at the bottom indicating that re-calibration is needed to maintain the accuracy indicated in the User Calibration Threshold.

For an HPD signal, only the in-band power meter is available. The in-band power measurement accuracy without a user calibration is ±1 dB. User calibration will improve the accuracy at a specific frequency, bandwidth, and temperature by using the broadband power meter to correct the in-band power measurement. This correction occurs when an in-band user calibration is performed.

Follow Procedure 5-33 to perform in-band power meter user calibration for the Aeroflex 3900 series HPD service monitor.

Procedure 5-33 How to Perform In-band Power Meter User Calibration

1	Press the **UTILS** button on the service monitor twice. **NOTE** Wait for approximately 1 second or more before pressing the **UTILS** button the second time. **Result:** The Utility Menu screen appears.
2	Select **User Calibration** from the drop-down menu. **Result:** The User Calibration screen appears.

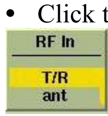
Procedure 5-33 How to Perform In-band Power Meter User Calibration (Continued)

3	Click the **Run User Calibration** button located at the upper right corner of the User Calibration screen. **NOTE** The default user calibration setting is 1.0 dB. This means that the HPD service monitor will not indicate a user re-calibration until the in-band power measurement has a potential of 1.0 dB error in the measurement (same as the basic in-band power meter accuracy). For HPD, a 0.5 dB value or lower is more appropriate. This may require more frequent user re-calibrations, but it provides better performance. **Result:** A User Calibration message box appears asking you to remove all connectors from the ports.
4	Remove all connectors from the ports and then click **Continue**. **Result:** A progress bar appears showing the progress of the calibration process. The calibration completes in approximately two minutes. **NOTE** Failure to remove all connectors and cables from the ports causes an inaccurate user calibration. Any connectors present will cause a variation on the impedance seen by the instrument during calibration.

Measuring HPD BR Tx Power, Frequency Accuracy and Tx EVM

In Procedure 5-34, the service monitor receives and provides readings on transmissions from the base radio.

Procedure 5-34 How to Measure HPD BR Tx Power, Frequency Accuracy and Tx EVM

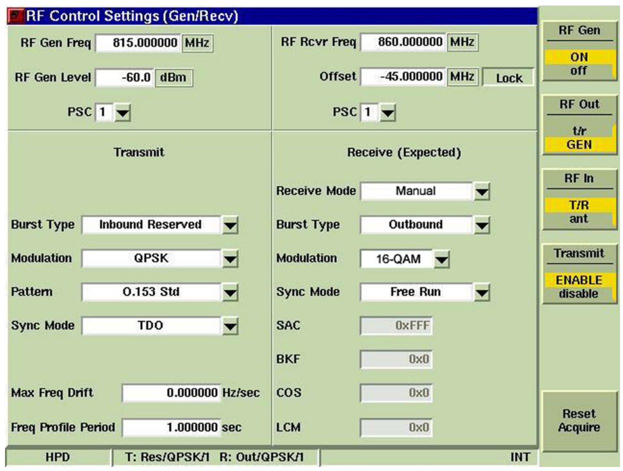
1	Perform the service monitor setup steps in Procedure 5-32.
2	Configure the service monitor T/R port to receive transmissions from the base radio, as follows: • Click the **T/R** soft key under **RF In** on the right side of the screen. 

Procedure 5-34 How to Measure HPD BR Tx Power, Frequency Accuracy and Tx EVM (Continued)

3

Maximize the RF Control Settings window, by clicking the upper left corner of the window.

Figure 5-25 HPD Service Monitor - RF Control Settings Window (Aeroflex 3900 Series Service Monitor)



4

Set RF Receiver Frequency, as follows:

- Click the **RF Rcvr Freq** field in the upper right quadrant of the RF Control Settings window.
- Press the number buttons on the front of the service monitor to enter a value in the **RF Rcvr Freq** field.
- If **MHz** is not already displayed to the right of the RF Receiver Frequency value you entered, press the unlabeled button on the front of the service monitor next to the **MHz** soft key.

NOTE

The value you enter should be within the Frequency Range specification for the GTR 8000 Base Radio configuration you are testing. See “GTR 8000 Base Radio Specifications” in the Description chapter of this documentation.

5

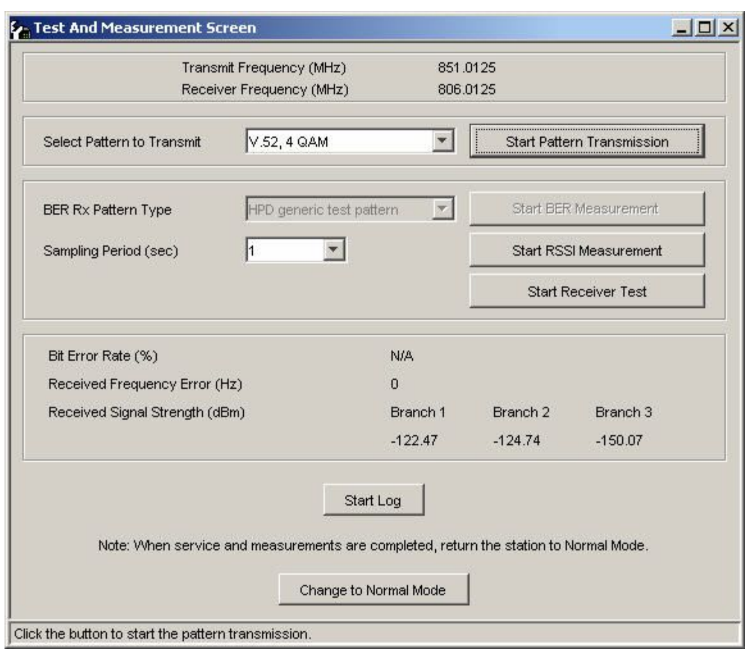
Select **1** from the drop-down list for Pilot Sync Code **(PSC)** in the upper right quadrant of the RF Control Settings window.

6

Make the following selections in the “Receive (Expected)” quadrant of the RF Control Settings window:

- Select **Manual** from the drop-down list for **Receive Mode**.
- Select **Outbound** from the drop-down list for **Burst Type**.
- Select **16-QAM** from the drop-down list for **Modulation**.
- Select **Free Run** from the drop-down list for **Sync Mode**.

Procedure 5-34 How to Measure HPD BR Tx Power, Frequency Accuracy and Tx EVM (Continued)

7	Minimize the RF Control Settings window, by clicking the upper left corner of the window. **Result:** The minimized RF Control Settings window is visible at the top of the screen as long as all subscreens are minimized. (See Figure 5-24.) Modulation Type is not visible in the minimized RF Control Settings window but displays with Burst Type and PSC at the bottom of the screen.
8	Open the **Test and Measurement Screen** from the CSS Service menu.
9	On the CSS Test and Measurement Screen: • Click the **Change to Service Mode** button. • Re-open the Test and Measurement Screen. • Key up the base radio for 16-QAM modulation by selecting **16-QAM** in the Select Pattern to Transmit field. • Click the **Start Pattern Transmission** button. **Figure 5-26** CSS Test and Measurement Screen 

Procedure 5-34 How to Measure HPD BR Tx Power, Frequency Accuracy and Tx EVM (Continued)

10

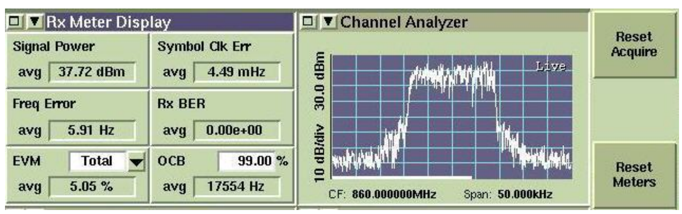
Display the base radio's transmission readings on the service monitor's Rx Meter subscreen, as follows:

- Click the Rx Meter subscreen.

A panel of soft keys displays on the right side of the screen, including two **Reset** keys.

- Click the **Reset Acquire** soft key on the right side of the screen. This re-synchronizes the test set with the incoming signal.
- Click the **Reset Meters** soft key on the right side of the screen. This stops, clears, and restarts the acquisition of data for the data display fields.

Figure 5-27 HPD Service Monitor - Rx Meter Subscreen, Reset Soft Keys (Aeroflex 3900 Series Service Monitor)



11

Compare the value that displays in the **Signal Power** field to the base radio Tx Power Out specification **that matches your base station configuration.** See "GTR 8000 Base Radio Specifications" in the Description chapter of this documentation.

NOTE

Be sure to account for cable loss in this comparison.

NOTE

The output power reference plane is the output connector of the power amplifier. The loss of the transmitter output cable (PA output to the back of the base radio) is 4% at 700 and 800 MHz. However, the base radio software allows the transmitter output power to be set at 10% above rated value.

12

Note the value that displays in the **Freq. Error** field. Tolerance should be +/- 50 Hz.

13

Note the value that displays in the **EVM avg** field. The value should be less than or equal to 10%.

14

If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.

Measuring HPD BR Rx Sensitivity and Rx BER

You can use Procedure 5-35 to test:

- **Rx Sensitivity:** Does the 1% Bit Error Rate (BER) meet specifications for your GTR 8000 Base Radio configuration?
- **Rx BER:** Does -70 dBm produce a 0.01% Bit Error Rate (BER) or better, as expected?

Procedure 5-35 How to Measure HPD BR Rx Sensitivity and Rx BER

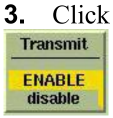
1 Perform the service monitor setup steps in Procedure 5-32.

2 Using the soft keys on the right side of the screen, configure the service monitor GEN port to generate inbound signaling to the base radio, as follows:

1. Click the **on** soft key under **RF Gen**.

2. Click the **gen** soft key under **RF Out**.

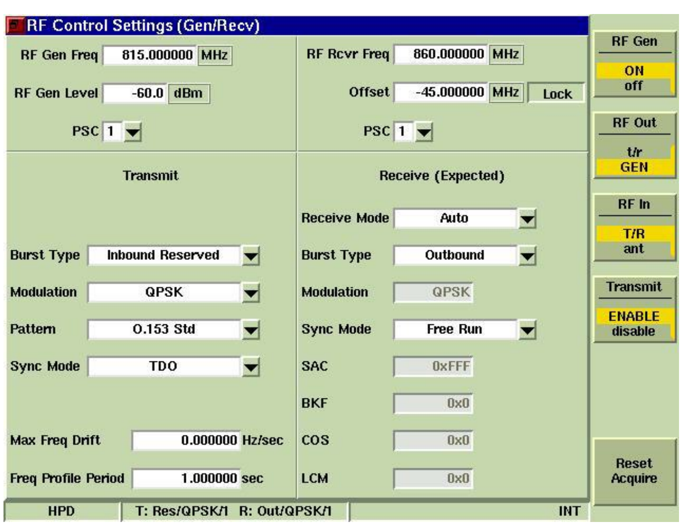
3. Click the **enable** soft key under **Transmit**.



3 Maximize the RF Control Settings window, by clicking the upper left corner of the window.

Result: All of the RF Control Settings fields display, as shown in Figure 5-28.

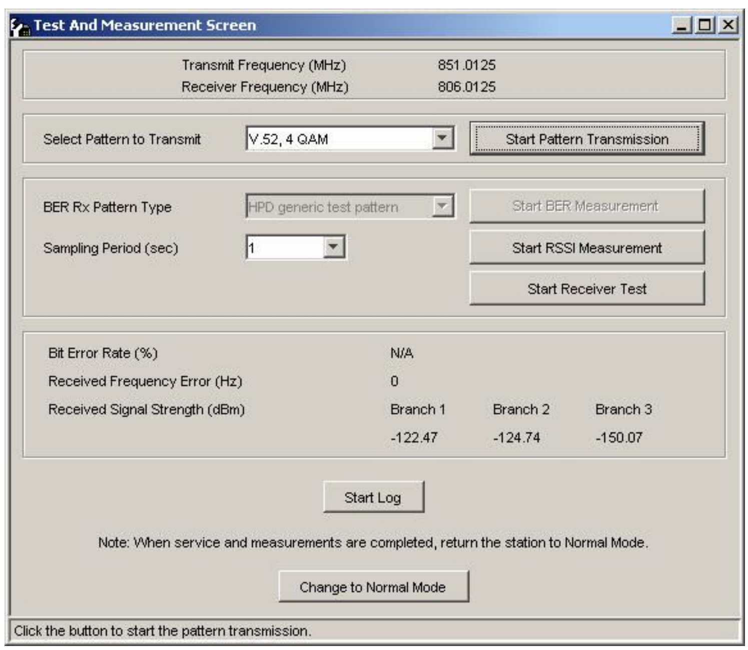
Figure 5-28 HPD Service Monitor - RF Control Settings Window (Aeroflex 3900 Series Service Monitor)



Procedure 5-35 How to Measure HPD BR Rx Sensitivity and Rx BER (Continued)

4	Select the following values in the Transmit quadrant of the RF Control Settings window: • Select **Inbound Reserved** for **Burst Type**. • Select a **Modulation Type**. **NOTE** Your selection should be a modulation type from HPD Receive Sensitivity 1% BER specifications, which include: • 64 QAM (Quadrature Amplitude Modulation) • 16 QAM • QPSK (Quadrature Phase Shift Keying) See "GTR 8000 System Specifications" in the Description section of this documentation. • Select **TDO** for **Sync Mode**. • Select **0.153 Std** for **Pattern**.
5	Select **Free Run** for **Sync Mode** in the Receive (Expected) quadrant of the RF Control Settings window.
6	Select the following values in the upper left quadrant of the RF Control Settings window: **1.** Click the **RF Gen Freq** field and use the number buttons on the front of the service monitor to enter a value. **NOTE** The value you enter should be within the Frequency Range specification for the HPD base radio configuration you are testing. See "GTR 8000 Base Radio Specifications" in the Description section of this documentation. **2.** Click the **RF Gen Level** field and enter a dBm value, depending on the length of cable between the service monitor and the base radio. **NOTE** The value you enter should match the Receive Sensitivity 1% BER specifications for your HPD base radio's configuration, for the Modulation Type you selected. See "GTR 8000 Base Radio Specifications" in the Description section of this documentation. **3.** Select **1** from the drop-down list for Pilot Sync Code **(PSC)**.

Procedure 5-35 How to Measure HPD BR Rx Sensitivity and Rx BER (Continued)

7	Minimize the RF Control Settings window, by clicking the upper left corner of the window. **Result:** The minimized RF Control Settings window is visible at the top of the screen as long as all subscreens are minimized. See Figure 5-24. Modulation Type is not visible in the minimized RF Control Settings window but displays with Burst Type and PSC at the bottom of the screen.
8	Connect to the base radio's transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
9	Open the **Test and Measurement Screen** from the CSS Service menu. **Figure 5-29** CSS Test and Measurement Screen 

Procedure 5-35 How to Measure HPD BR Rx Sensitivity and Rx BER (Continued)

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Set up the CSS Test and Measurement screen to display received BER through Configuration/Service Software (CSS), as follows:

1. On the CSS Test and Measurement Screen, click the **Change to Service Mode** button. This keys up the base radio in service mode.
2. Re-open the Test and Measurement Screen.
3. Select a pattern that matches your Modulation Type selection for the RF Control Settings in the service monitor.

NOTE

To match the QPSK Modulation Type on the service monitor screen, select the 4 QAM pattern in CSS.

4. Click the **Start Pattern Transmission** button.
5. Click the **Start BER Measurement** button.

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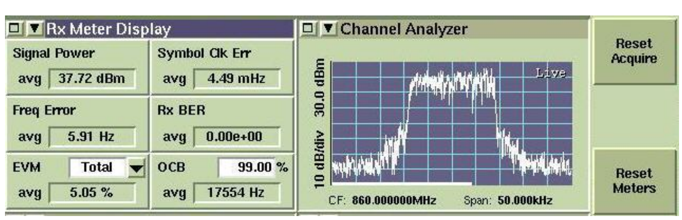
Display the base radio's transmission readings on the service monitor Rx Meter subscreen, as follows:

- Click the Rx Meter subscreen.

A panel of soft keys displays on the right side of the screen, including two **Reset** keys.

- Click the **Reset Acquire** soft key on the right side of the screen. This re-synchronizes the test set with the incoming signal.
- Click the **Reset Meters** soft key on the right side of the screen. This stops, clears, and restarts the acquisition of data for the data display fields.

Figure 5-30 HPD Service Monitor - Rx Meter Subscreen and Soft Keys (Aeroflex 3900 Series Service Monitor)



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On the RF Control Settings window of the service monitor, enter lower values in the **RF Gen Level** field until 1% BER is displayed on the CSS Test and Measurement screen. Compare the value in the **RF Gen Level** field to the Receive Sensitivity 1% BER specifications for your HPD base radio configuration. See “GTR 8000 Base Radio Specifications” in the Description section of this documentation.

NOTE

Be sure to take cable and splitter loss into account.

Procedure 5-35 How to Measure HPD BR Rx Sensitivity and Rx BER (Continued)

13	Enter -70 dBm in the **RF Gen Level** field. **NOTE** This should produce a 0.01% or better BER on the Test and Measurement screen in CSS. If it does not, contact Motorola System Support Center (SSC). See “Using Motorola System Support Center (SSC)” in the Troubleshooting chapter of this document.
14	When finished testing, perform the following steps in CSS on the Test and Measurement screen: • Click the **Stop BER Measurement** button. • Click the **Stop Pattern Transmission** button.
15	If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.

Checking Receiver Sensitivity (Self-test Method) (HPD)

Procedure 5-36 explains how to check the receiver sensitivity for the station without any test equipment. The receiver uses a factory calibrated low-level noise source at the receiver input to check performance. This procedure can be performed remotely.

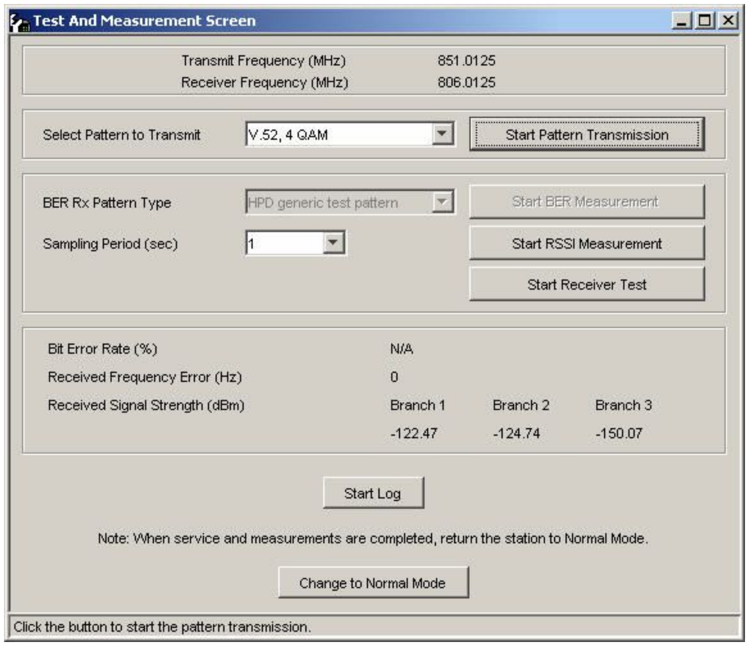
Procedure 5-36 How to Check the Receiver Sensitivity (Self-test Method) (HPD)

1	Connect to the base radio's transceiver module in CSS through an Ethernet connection. See “Connecting Through an Ethernet Port Link” in the Configuration chapter.

Procedure 5-36 How to Check the Receiver Sensitivity (Self-test Method) (HPD) (Continued)

2 Open the **Test and Measurement Screen** from the CSS Service menu.

Figure 5-31 CSS Test and Measurement Screen



3 Reset the base radio:

1. If the base radio is not already is service mode, click **Change to Service Mode**.

Result: A confirmation dialog box appears.

2. Click **OK**.

Result: The base radio begins a reset sequence to change modes, which takes a few minutes.

3. After the base radio resets, you must re-open the Test and Measurement Screen dialog box as described in step 2.

4 Select **Start Receiver Test**.

Result: A confirmation dialog box appears indicating test's progress. After a few seconds, the test will conclude with a pass or fail message.

5 Click **OK**.

6 If no further testing is needed, click **Change to Normal Mode** to return the base radio to normal operation.

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Chapter

6

GTR 8000 Base Radio Maintenance

This chapter describes periodic maintenance procedures relating to the GTR 8000 Base Radio.

Fan Grill Cleaning Instructions

NOTE

If the station equipment is installed in a particularly dusty environment, precautions must be taken to filter the air used for forced cooling of the station. Excessive dust drawn across and into the station circuit modules by the cooling fans can adversely affect heat dissipation and circuit operation. In such installation, be sure to clean or replace external filtering devices periodically.

If dust has accumulated on the fan grills, cleaning of the fan grills is recommended. When cleaning, care should be taken to prevent dust from being pulled into the modules. It is recommended that a damp cloth be used to wipe the front of the fan grills. When removing the power supply, make sure that the unit is turned off before proceeding.

Aligning the Internal Frequency Reference Oscillator

NOTE

The base radio or receiver must be turned on for at least one week before the internal frequency reference oscillator is aligned.

The internal frequency reference oscillator for an OCXO transceiver option card must be aligned:

- Upon installation of the base radio or receiver for all bands.
- Once every two years after installation for 700/800 MHz systems.
- Once every five years after installation for UHF systems.
- VHF systems do not require alignment after initial installation.

The internal frequency reference oscillator for an TCXO transceiver option card must be aligned:

- Upon installation of the base radio or receiver for UHF.
- Every year after installation for UHF.

See Base Radio Service Help > Service Screens > Alignment Screens in the *CSS Online Help* for the alignment procedures.

Chapter

7

GTR 8000 Base Radio Operation

This chapter details tasks that you will perform once the GTR 8000 Base Radio is installed and operational on your system.

Base Radio Operational States For Trunked Simulcast

A GTR 8000 Base Radio can be in one of four operational states:

- Standby
- Idle
- Assigned
- Isolated

During initialization, the base radio powers up into the **standby** state and waits for a status packet from the comparator. After initial contact with the comparator has been made, the base radio enters **idle** mode and sends a status message back to the comparator indicating that it is ready for assignment. The comparator then responds with a channel grant message, and the base radio enables for service.

After a base radio has been **assigned**, it can begin to handle inbound/outbound traffic. In the case where the base radio fails to receive a number of consecutive status packets from the comparator, the base radio enters **isolated** mode and dekeys. This isolated mode is reported in the Unified Event Manager.

If the base radio becomes operational again and receives status packets from the comparator, it replies with a channel status message. The comparator may then respond with a channel grant, and the base radio becomes enabled for service again.

Base Radio Operational States for Trunked Repeater and HPD

A GTR 8000 Base Radio can be in one of four operational states:

- Standby
- Idle
- Assigned
- Isolated

During initialization, the base radio powers up into the **standby** state and waits for a status packet from the site controller. After initial contact with the site controller has been made, the base radio enters **idle** mode and sends a status message back to the site controller indicating that it is ready for assignment. The site controller responds with a channel grant message, and the base radio enables for service. If the base radio has a greater home channel preference setting than other base radios at the site, then the zone controller assigns the base radio as the home channel at the site.

After a base radio has been **assigned**, it can begin to handle inbound/outbound traffic. In the case where the base radio fails to receive a number of consecutive status packets from the site controller, the base radio enters **isolated** mode and dekeys. This isolated mode is reported in the Unified Event Manager.

If the base radio becomes operational again and receives status packets from the site controller, it replies with a channel status message. The site controller may then respond with a channel grant, and the base radio becomes enabled for service again.

Base Radio Operational States for Conventional

A GTR 8000 Base Radio can be in one of two operational states:

- Standby/Receiving
- Transmit

During initialization, the base radio powers up into the **standby/receiving** state and is enabled for service. The base radio listens for any received transmissions.

After the base radio has received a transmission, it can then key-up and **transmit**.

NOTE

The GPW 8000 Receiver does not transmit.

Packet Data interactions with Multiple NAC’s

If a base radio supports multiple NAC’s, such as when using the community base radio feature (F7F/F7E), in addition to a default NAC, inbound data can be received on any incoming NAC and is forwarded to its destination. Outbound data is only transmitted to the default NAC. Outbound data cannot be routed to a selected NAC, it is always sent on the default NAC. Repeated data is only transmitted on the default NAC and does not follow the inbound NAC when community repeater (F7F) is being used.

Supplementary Signaling interactions with Multiple NAC’s

If a base radio supports multiple NAC’s, such as when using the community base radio feature (F7F/F7E), in addition to a default NAC, inbound supplementary signaling can be received on any incoming NAC and is forwarded to its destination. Outbound supplementary signaling is transmitted on either the default NAC or the currently selected NAC if using F7F/F7E, the same that voice would be transmitted. Outbound supplementary signaling cannot be routed to a selected NAC, it is always sent using either the default NAC or the same NAC that voice would be transmitted on according to F7F/F7E functionality.

Illegal Carrier Determination Feature (Trunked)

The Illegal Carrier Determination feature allows radio channels to continue operating with system configurable levels of channel interference. In an ASTRO® 25 system, the base radio uses Received Signal Strength Indicator (RSSI), an RF Threshold Value, and the Malfunction Timer Value to implement this feature. Table 7-1 summarizes when an illegal carrier is determined:

Table 7-1 Illegal Carrier Determination

If the channel receives a...	and is assigned:	and is not assigned:
Valid Network Access Code (NAC)	The base radio does not change since the carrier is considered valid.	If the RF Threshold Value is exceeded, the base radio enters the Illegal Carrier state and the base radio generates an Illegal Carrier message to UEM.
Invalid Network Access Code (NAC) OR Carrier activity without NAC	If the RF Threshold Value level is exceeded, the Malfunction Timer Value is activated. After the timer expires, the base radio enters the Illegal Carrier state and the base radio generates an Illegal Carrier message to UEM. If the illegal carrier disappears or drops below the RF Threshold Value for 12.5%, but not less than 10 seconds of the time period defined by the Malfunction Timer Value, an event is sent to UEM.	

RF Channel Interference Determination Feature (Conventional)

The RF Channel Interference Determination Feature allows radio channels to detect RF interference and log it to the station log. RF Channel Interference is declared when the Carrier Squelch level is exceeded and none of the receive qualifiers are met. Receive qualifiers are the programmed PL, DPL, or Rx NAC for the currently active channel.

Chapter

8

GTR 8000 Base Radio Troubleshooting

GTR 8000 Base Radio troubleshooting requires an understanding of hardware-based and software-based diagnostics, as well as testing tools. Support is available from Motorola to assist with all steps in the troubleshooting process.

This chapter provides fault management and troubleshooting information relating to GTR 8000 Base Radio.

General Troubleshooting

Table 8-1 describes steps for general GTR 8000 Base Radio troubleshooting.

Table 8-1 GTR 8000 Base Radio General Troubleshooting

Problem	Troubleshooting
General connectivity problems	**1.** If you have access to the equipment, check the LEDs to verify that each piece of equipment is connected and operational. See “LEDs” in the Reference section of the documentation. **2.** In CSS, check the condition of the base radio and all associated devices and links. **3.** Verify the configuration of the base radio through CSS. Verify that the IP address for the base radio is correct. In CSS, send a diagnostic command to enable the base radio. **4.** Verify that the DNS Hostname for the base radio is correct. If the DNS Hostname was incorrect and then corrected, further corrections may be needed on the DNS server, UNC, and UEM. See the Troubleshooting chapter in the *Authentication Services* manual. **5.** Verify that the physical cabling is firmly connected and in good condition. Check for any sharp bends or kinks in cabling. Test suspected cabling for noise, continuity, attenuation, and crosstalk. Replace the cabling if necessary. **6.** Run ping, traceroute, pathping, and other network administration commands to identify any link or intermediate devices (switch or routers) with high latency or connection problems.

Table 8-1 GTR 8000 Base Radio General Troubleshooting (Continued)

Problem	Troubleshooting
	7. If the connection fails to operate normally, send a restart command to the base radio through CSS. Consider cycling power to the base radio if necessary. **8.** If the base radio still fails to operate properly, create a backup of the current configuration, then reinstall the software and reconfigure the base radio. **9.** Replace the base radio if necessary.
Device will not power up	**1.** If you have access to the equipment, check the LEDs to determine which equipment is connected and operational. See “LEDs” in the Reference section of the documentation. **2.** In CSS, check the alarms for the base radio. **3.** Check the power cabling and verify that the power source for the base radio is supplying the appropriate voltage. Try connecting the base radio to another power source or replace the power cabling if necessary. **NOTE** Check all power sources as there may be more than one. **4.** Check for any physical damage to the modules and check whether the modules were properly grounded. **5.** Replace any defective modules.
Device is in a continuous reset state	Assure reference inputs are connected to the appropriate input.
Exciter Failure	Verify that an antenna relay that is Enabled either in the UNC or CSS may have been disconnected. This causes the base radio to generate an exciter failure because the antenna relay is controlled and monitored through the exciter module. However, the exciter failure should be ignored until after the antenna relay failure is corrected.
Analog (4-wire) Portion of V.24 Hybrid Link Failure	In a mixed mode configuration, with hybrid links, and when analog link monitor tone is enabled (Analog Link Idle Check is enabled in the CSS), the base radio detects a link failure when the analog link monitor tone and call activity are absent on the receive line (WL1). Analog Idle Link Check in the CSS should be disabled when comparator type is ASTRO-TAC with DIGI-TAC or ASTRO-TAC with MLC 8000. When these failure conditions are met, the base radio will: **1.** Log an occurrence of the failure in the base radio's local event log, which is retrievable through the configuration interface. **2.** If connected to centralized fault management equipment (optional) then the base radio transmits an alarm indication to the fault manager to alert the system administrator of the failure. **3.** A local visual indication is active due to this failure. Recovery of the link failure results in a similar set of actions to indicate that the failure event cleared. Note that a failure of the transport line or a failure of the opposing host on the wireline link will both appear to the base radio as a link failure. The base radio cannot distinguish between these two cases.

Table 8-1 GTR 8000 Base Radio General Troubleshooting (Continued)

Problem	Troubleshooting
V.24 Portion of Hybrid Link Fails	In a mixed mode configuration, with hybrid links, the base radio detects a V.24 link failure when packet activity is absent for a period of time on the outbound transmit line. When these failure conditions are met, the base radio will: **1.** Log an occurrence of the failure in the base radio's local event log, which is retrievable through the configuration interface. **2.** If connected to centralized fault management equipment (optional) then the base radio transmits an alarm indication to the fault manager to alert the system administrator of the failure. **3.** A local visual indication is active due to this failure. **4.** Invoke a failure announcement for the 4-wire link because the activity on the 4-wire link is driven by control signaling on the V.24 link. 4-wire link cannot be used when the V.24 link is down. Recovery of the link failure results in a similar set of actions to indicate that the failure event cleared. Note that a failure of the transport line or a failure of the opposing host on the wireline link will both appear to the base radio as a link failure. The base radio cannot distinguish between these two cases.
Transceiver Option Card Hardware Malfunction	In the event the base radio detects a hardware issue with the transceiver option card, when used for analog and mixed mode operation, it will: **1.** Log an occurrence of the failure in the base radio's local event log, which is retrievable through the configuration interface. **2.** If connected to centralized fault management equipment (optional), then the base radio transmits an alarm indication to the fault manager to alert the system administrator of the failure. The alarm will be associated with the base radio's control module. **3.** A local visual indication is active due to this failure.
Front Fan Malfunction	In the event the fan assembly malfunctions, the base radio will: **1.** Log an occurrence of the failure in the base radio's local event log, which is retrievable through the configuration interface **2.** If connected to centralized fault management equipment (optional), then the base radio transmits an alarm indication of "warning" severity to the fault manager to alert the system administrator of the failure. The alarm will be associated with the base radio's control module. **3.** The base radio provides a local visual indication associated with the failure. **4.** In the event the base radio detects the maximum operable temperature has been exceeded, then the base radio transitions to a critical malfunction state, log the state change, and generate a fault indication if connected to the UEM.

Table 8-1 GTR 8000 Base Radio General Troubleshooting (Continued)

Problem	Troubleshooting
Power Consumption is greater than 35 W with power efficiency package	The following conditions must be met to obtain a power consumption of less than or equal to 35 W: • DC source only • Speaker turned OFF (if equipped with transceiver option card) • No AUX loads • CSS configured for applications not required for receiver diversity • CSS Fan Holdover configured to “short” (45 seconds) (length of time the base radio fan stays ON after transmission) • Ambient temperature of 104 degress F (40 degress C) or less (single fan operation – disabling one of the fans within the fan module. See “Removing/Replacing the Fan Module” in the FRU Procedures chapter for instructions on how to disable the fan.) NOTE Single fan operation requires the Tx Power Out in the CSS to be limited to 50 W. • Transceiver, power amplifier, power supply, fan, and optional TCXO transceiver option card are all power efficiency package versions

Troubleshooting Tools

Below is the information needed for viewing and monitoring equipment and troubleshooting suspected problems.

- “LEDs” in the Reference section
- "Using Unified Event Manager to Monitor Links and Components"
- "MOSCAD Network Fault Management (NFM)"
- "Using Unified Network Configurator for GTR 8000 Base Radio Troubleshooting"
- "Using Configuration/Service Software (CSS) for GTR 8000 Base Radio Troubleshooting"

In addition the following information is provided in this documentation for testing system performance:

- “Quick Connect RF Coaxial Adapters for GTR 8000 Base Radio Support” in the Installation chapter.

Using Unified Event Manager to Monitor Links and Components

Use Unified Event Manager (UEM) to monitor critical links and components in the system. Monitoring may take place remotely from a central operations center. Two types of monitoring include:

- Real-time monitoring of UEM Topology Maps, which alert you of faults as they occur.
- Evaluation of UEM Active Alarms Window on a regularly scheduled basis.

Analyzing Unified Event Manager Active Alarms Window

The Unified Event Manager (UEM) Active Alarms Window is useful for troubleshooting because it captures alarms that may occur intermittently or during off-hours. For example, you can review the Active Alarms Window to correlate reported loss of service with patterns of critical alarms for links and equipment.

When analyzing the Active Alarms Window, look for the following types of patterns:

- Failures sent with time stamps on or about the same time.
- Failures from related equipment:
  - Cards in the same device
  - Equipment that is part of the same subsystem

Many devices are capable of sending out events that report both critical and non-critical events. Learn to distinguish between critical and non-critical events.

See the *UEM Online Help* manual for further details.

Diagnostic Options in UEM

Table 8-2 summarizes the base radio diagnostic options.

Table 8-2 Base Radio Diagnostic Options in UEM

Option	Description
Restart	Requests that the base radio perform a reset.
Service	Requests that the base radio enters service mode, allowing a technician to make alignment adjustments and run other tests while the base radio is offline.
Enabled	Requests that the base radio enter the enabled mode and handle traffic.

MOSCAD Network Fault Management (NFM)

If MOSCAD NFM is supported at the site, additional status and alarm information for the devices can be viewed through MOSCAD NFM. For viewing status and alarm information for a device, see the *MOSCAD Network Fault Management* manual.

Using Unified Network Configurator for GTR 8000 Base Radio Troubleshooting

Use the Unified Network Configurator (UNC) to verify configuration data during system commissioning and later when you maintain or expand the system. Use UNC to:

- Verify configuration.
- Correct configuration errors.

See the *Unified Network Configurator* manual for further details.

Using Configuration/Service Software (CSS) for GTR 8000 Base Radio Troubleshooting

The GTR 8000 Base Radio can be locally or remotely configured or serviced through Configuration/Service Software (CSS). CSS provides access to alarms, status information, and configuration settings for the base radio.

You can use CSS for the following tasks which may be useful when troubleshooting the base radio. See the *CSS Online Help* for specific details and instructions when performing these tasks.

- Enable and disable channels and services.
- View and save a log of base radio alarms.
- Verify the base radio configuration.
- Gather troubleshooting information that can be escalated to Motorola for evaluation.

Alarm Log from Internal Diagnostic Tests

The GTR 8000 Base Radio has been designed with internal diagnostic tests that occur on power up and reset. Diagnostic tests are available for the control module and power supply. If a problem occurs during operation, it is reported as an alarm. All alarms are stored in the Alarm Log, accessible with CSS. The alarm log contains the name of the diagnostic test that failed and the time since the last power up.

Resetting Passwords and SNMPv3 Passphrases

You can enable/disable the password reset mechanism in the CSS application. See Secure Remote Access Confguration –> Device Security Configuration - Security Services (Serial) in the *CSS Online Help* for information. To obtain the keys for resetting either password or SNMPv3 passphrases for the device, contact Motorola Solutions Customer Support.

NOTE

The default values for the local passwords and SNMPv3 passphrases, as well as the keys for the local password reset procedure, may vary by system release. These are treated as sensitive information and are provided to your organization through secured communication.

Table 8-3 Local Password and SNMPv3 Passphrase Troubleshooting

Scenario	SNMPv3 Passp-hrase Known	Local Password Known	To Reset SNMPv3 Passphrase	To Reset Local Login Password
User is locked out of local login, but knows SNMPv3 passphrases	✓	✗	See the *CSS Online Help's* “SNMPv3 User Configuration”.	See the *CSS Online Help's* “Resetting Device Passwords.”
User knows local login, but not the SNMPv3 passphrases	✗	✓	See the *CSS Online Help's* “Reset SNMPv3 Configuration (Serial)”.	See the *CSS Online Help's* “Device Security Configuration – Security Services (Serial)”
User knows both passphrases and local service password	✓	✓	See the *CSS Online Help's* “SNMPv3 User Configuration”.	See the *CSS Online Help's* “Device Security Configuration – Security Services (Serial)”
User does not know SNMPv3 passphrase nor service account password	✗	✗	Contact Motorola Solutions Customer Support.	Contact Motorola Solutions Customer Support.

Site Controller Failure - Impact on GTR 8000 Base Radio for Trunked Operation

If the link fails between the base radio and the site controller, the base radio dekeys and will not handle any MSU traffic. MSUs will attempt to operate on another channel at the site. If another channel is not available, the MSUs will attempt to register at another site.

For HPD operation, the base radio receives external frequency reference and network time synchronization from the active site controller over the Ethernet link. In the event of loss of the external time and frequency reference source, the base radio will continue to maintain its own time and frequency stability to continue operations for a specified amount of time without degradation. After a period of time, operation will continue with minimal degradation.

Conventional Site Controller Failure - Impact on GTR 8000 for Conventional Operation

For IP interfaced conventional base radios, a conventional site controller provides support for dispatch consoles to manage and control the conventional base radios in K1/K2 and M1/M2/M3 type systems, the conventional site controller only provides support for the console to manage and control the conventional base radios when the primary (and optional secondary) zone controllers are not reachable.

If the conventional site controller fails when it is the active call controller in either type system, the dispatch console loses it's ability to manage and control the channel resources. However, subscriber radios may still be able to maintain communications using repeat functionality of the base radios or when the base radios are connected to a comparator. The comparators repeat functionality enables wide area repeat for subscribers.

Using Motorola System Support Center (SSC)

Motorola System Support Center (SSC) can help technicians and engineers resolve system problems and ensure that warranty requirements are met. Check your contract for specific warranty information.

Motorola assigns a tracking ticket number that identifies each support call. This allows Motorola to track problems, resolutions, and activities for the call. If possible, communicate the resolution and a status of call so that the Motorola System Support Center (SSC) can note the resolution and close the ticket.

Gathering Information Before Calling Motorola

Before calling one of the support centers, log any and all steps taken to troubleshoot the problem and any results of those steps. The Motorola System Support Center (SSC) can use this information to determine the appropriate support actions.

Collect the following information:

- System ID number (such as 2CB5). Each zone in the system has a unique system ID number.
- Location of the system
- Date the system was put into service
- Software and firmware versions

- Symptom or observation of the problem, such as:
  - When did it first appear?
  - Can it be reproduced?
  - Are there any other circumstances contributing to the problem (for example, loss of power)?
- Maintenance action preceding the problem, such as:
  - Upgrade of software or equipment
  - Changes to hardware or software configuration
  - Reload of software from a backup disk or from CD with the version and date

Where to Call for Service

After collecting the required information and writing a detailed problem report, contact one of the following support centers to help with the problem:

- Motorola System Support Center (SSC)

Motorola System Support Center (SSC)

The Motorola System Support Center (SSC) is the primary Motorola contact. Call Motorola System Support Center (SSC):

- Prior to any software reload.
- To confirm troubleshooting results and analysis prior to removing and replacing a Field Replaceable Unit (FRU) or Field Replaceable Equipment (FRE) to repair the system.

Motorola System Support Center (SSC):
Phone: (800) 221-7144 for domestic calls and (847) 576-7300 for international calls
Fax: (847) 725-4073

Use of Subcontractors

The Motorola System Service Subcontractor Assessment program ensures that service people contracted by Motorola meet strict minimum requirements before they can work on any systems. For more information on this program, contact the Motorola representative.

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Chapter

9

GTR 8000 Base Radio FRU Procedures

GTR 8000 Base Radios are comprised of numerous field replaceable units (FRUs) and field replaceable parts. If you need to replace a FRU or part, it is essential to obtain the precise FRU Kit Number or Part Number and to review the replacement procedures provided, including all safety precautions and system impact information.

This chapter lists the Field Replaceable Units (FRUs) and Field Replaceable Entities (FREs) and includes replacement procedures applicable to GTR 8000 Base Radio.

Field Replaceable Units (FRUs) and Parts

When ordering field replaceable units (FRUs), you will need the FRU Kit Number. When ordering field replaceable parts, you will need the Part Number. Contact Motorola System Support Center (SSC) as needed for numbers not provided here (for cables that are internal to a GTR 8000 Base Radio, the part numbers are not listed in this documentation, but you can locate the part number on the cable itself before contacting Motorola Support). See "Using Motorola System Support Center (SSC)" in the Troubleshooting section of the documentation.

WARNING

To guard against personal injury and/or damage to equipment, switch a trunked base radio to Service Mode when performing service. The GTR 8000 Base Radio periodically keys up to pseudo train its linear transmitter autonomously when it is not assigned by the zone controller. Tx Inhibiting the base radio also prevents the transmitter from keying. Remember to switch the base radio back to Normal Mode when service is complete.

Table 9-1 GTR 8000 Base Radio Field Replaceable Units

Component Type	FRU Kit Number	Replacement Procedure
Transceiver Module (700/800 MHz)	DLN6566A	Procedure 9-1 on page 9-6
Transceiver Module (UHF R1, 380–435 MHz)	DLN1395A	

Table 9-1 GTR 8000 Base Radio Field Replaceable Units (Continued)

Component Type	FRU Kit Number	Replacement Procedure
Transceiver Module (UHF R2, 435–524 MHz)	DLN1346A	
Transceiver Module (VHF, 136–174 MHz)	DLN1376A	
Power Efficiency Transceiver Module (UHF R1, 380–435 MHz)	DLN6786A	
Power Efficiency Transceiver Module (UHF R2, 435–524 MHz)	DLN6789A	
Transceiver Module w/OXCO Transceiver Option Card (700/800 MHz)	DLN1430A	
Transceiver Module w/OXCO Transceiver Option Card (UHF R1, 380–435 MHz)	DLN1432A	
Transceiver Module w/OXCO Transceiver Option Card (UHF R2, 435–524 MHz)	DLN1433A	
Transceiver Module w/OXCO Transceiver Option Card (VHF 136–174 MHz)	DLN1431A	
Power Efficiency Transceiver Module w/TXCO* Transceiver Option Card (UHF R1, 380–435 MHz)	DLN6787A	
Power Efficiency Transceiver Module w/TXCO* Transceiver Option Card (UHF R2, 435–524 MHz)	DLN6790A	
Fan Module	DLN1338A	Procedure 9-2 on page 9-12
Power Efficiency Fan Module	DLN6804A	
AC/48V DC Power Supply	DLN6781A	Procedure 9-3 on page 9-14
Power Efficiency AC/48V DC Power Supply	DLN6793A	
Power Supply Fan Module	5985167Y02	Procedure 9-4 on page 9-17
Mid-Power (Power Amplifier Module) 700/800 MHz	DLN6567A	Procedure 9-5 on page 9-19
Mid-Power (Power Amplifier Module) UHF R1, 380–435 MHz	DLN1396A	
Mid-Power (Power Amplifier Module) UHF R2, 435–524 MHz	DLN1347A	
Power Efficiency Power Amplifier Module UHF R1, 380–435 MHz	DLN6788A	
Power Efficiency Power Amplifier Module UHF R2, 435–524 MHz	DLN6792A	

Table 9-1 GTR 8000 Base Radio Field Replaceable Units (Continued)

Component Type	FRU Kit Number	Replacement Procedure
Mid-Power (Power Amplifier Module) VHF, 136–174 MHz	DLN1377A	
GTR 8000 Base Radio Backplane	0180706G79	Procedure 9-6 on page 9-22

* Available only for non-simulcast conventional systems.

Table 9-2 GTR 8000 Base Radio RFDS Field Replaceable Parts

Component Type	Part Number	Replacement Procedure
Preselector 700 MHz	0185171Y02	Procedure 9-7 on page 9-29
Preselector 800 MHz	0185171Y01	
Preselector Mounting Bracket	0785024Y01	
Preselector QMA Cable End	3085664Y01	
Preselector BNC to QMA Cable	3085665Y01	
Preselector Mini UHF N-Bulkhead Cable	3085664Y02	
Preselector Mini UHF BNC Cable	3085664Y03	
Preselector UHF 380–433 MHz	CFX1075A	
Preselector UHF 435–470 MHz	TLE5992A	
Preselector UHF 470–524 MHz	TLE5993A	
Preselector VHF 136–154 MHz	TFD6511A	
Preselector VHF 150–174 MHz	TFD6512A	
Transmit Post Filter 700 MHz	9184680Y01	Procedure 9-8 on page 9-30
Transmit Post Filter 800 MHz	9184680Y02	
External Dual Circulator Tray	DLN1317A	Procedure 9-9 on page 9-34
External Dual Circulator Tray UHF 380–435	CLE6203A	
Duplexer 700 MHz	9184718Y01	Procedure 9-10 on page 9-37
Duplexer 800 MHz	9184718Y02	
Duplexer UHF 380–403 MHz	0185417U10	Procedure 9-11 on page 9-39
Duplexer UHF 403–435 MHz	0185417U04	
Duplexer UHF 435–470 MHz	0185417U05	
Duplexer UHF 470–494 MHz	0185417U06	
Duplexer UHF 494–512 MHz	0185417U07	
Duplexer VHF 136–146 MHz	0185417U01	Procedure 9-12 on page 9-40
Duplexer VHF 144–160 MHz	0185417U02	
Duplexer VHF 158–174 MHz	0185417U03	

Table 9-2 GTR 8000 Base Radio RFDS Field Replaceable Parts (Continued)

Component Type	Part Number	Replacement Procedure
Antenna Relay kit including relay, cable, screws	CLN8636A	Procedure 9-13 on page 9-42
Antenna Relay	40009272002	
External Speaker Kit	HSN1006A	
Microphone Kit	GMMN4063B	

Table 9-3 Individual Replaceable Parts on External Dual Circulator Tray

Component Type	Part Number	Replacement Procedure
Dual Circulator 700/800 MHz	0185172Y01	Procedure 9-9 on page 9-34
Dual Circulator UHF 380–435 MHz	0185416U09	
Dual Circulator UHF 435–470 MHz	0185416U05	
Dual Circulator UHF 470–524 MHz	0185416U06	
Dual Circulator VHF 136–146 MHz	0185416U01	
Dual Circulator VHF 144–160 MHz	0185416U02	
Dual Circulator VHF 158–174 MHz	0185416U03	
Circulator Load 700/800 MHz	TLN3391A	
Circulator Load UHF/VHF	TLN3391A	
Low Pass/Harmonic Filter 700/800 MHz	9185202U04	
Low Pass/Harmonic Filter UHF	9185856Y01	
Low Pass/Harmonic Filter VHF	9185856Y03	

Table 9-4 GTR 8000 Base Radio Cables

Component Type	Part Number
System Connector Cable – SCSI2 Base Radio to Champ	30009301004
Antenna Relay Control Cable	3084848Y01
Antenna Relay Mini UHF Cable	3085664Y04
Antenna Relay QMA Cable	3085664Y05
Antenna Relay BNC Cable	3013943J08
Antenna Relay 75 CM Cable	3013942M23
Antenna Relay 32 CM Cable	3013942M11
Antenna Relay 25 CM Cable	3013943E08

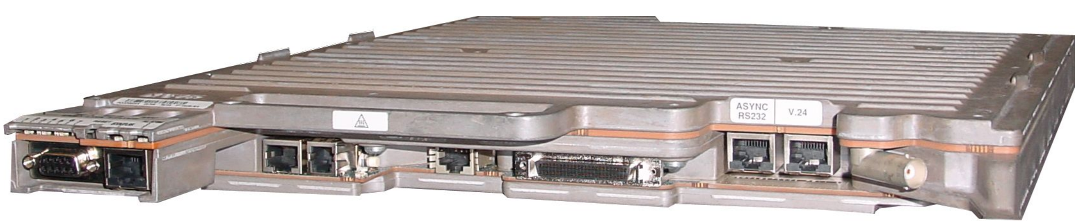
Table 9-4 GTR 8000 Base Radio Cables (Continued)

Component Type	Part Number
External Speaker Cable	0185180U01
Cable DC Red/Black 2806mm	3084869Y02
Cable DC Black/Blue 2806mm	3084869Y06
Battery Temp Sensor 3000mm	0184833Y01
Cable Battery Temp Extension 15500mm	3084827Y04

Replacing a Radio Transceiver Module

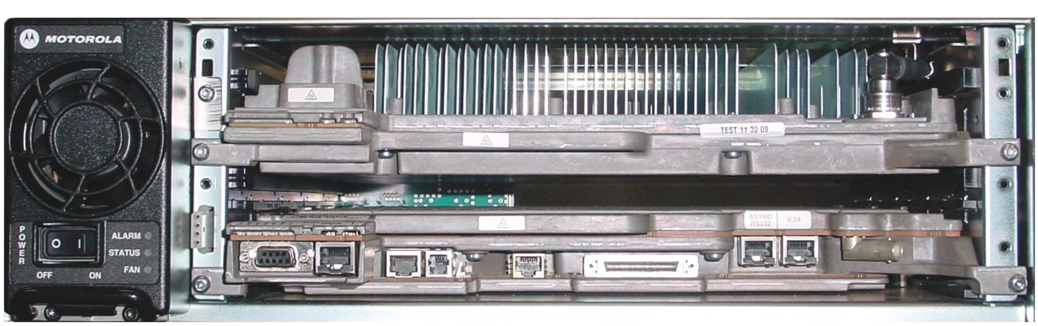
Figure 9-1 shows the Transceiver FRU module. Figure 9-2 shows the captive screws that secure the transceiver module to the chassis in the standalone base radio configuration.

Figure 9-1 Transceiver Module



GTR8000_XCVR_wSAC

Figure 9-2 GTR 8000 Base Radio Modules



GTR8000_XCVR_wSAC_chassis

NOTE

If you do not know the IP address for the device, it is available through a serial port connection in the **Tools**, **Set IP Address** from the menu.

IMPORTANT

Before replacing the transceiver, pull configuration and hardware information from the transceiver into the Unified Network Configurator (UNC) by performing a “Pull All” procedure from the UNC. For instructions on “How to Perform a Pull All” procedure, please refer to the *“Unified Network Configurator”* manual.
This step may not be possible if communication is severed between the transceiver and the UNC or if the transceiver is within a K1/K2 or non-networked site. If this scenario exists, perform any one of the following:

- Use the last known good configuration files from the UNC
- Extract the configuration files from the transceiver directly

Procedure 9-1 How to Replace a Transceiver Module

1	Wear an electrostatic discharge (ESD) strap and connect its cable to a verified good ground. Be sure to wear this strap throughout this procedure to prevent ESD damage to any components.
2	Locate the transceiver module you need to replace.
3	If the transceiver module is not operational, skip to step 8.
4	Connect to the base radio's transceiver module Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
5	Save the base radio configuration to the laptop PC as follows: **1.** From the File menu, select **Read Configuration From Device**. **2.** At the success message, click **OK**. **3.** From the File menu, select **Save As** and on the Properties Screen, enter the IP address of the base radio. Click **OK**. **4.** On the Save window, select the directory where you want to save the configuration file, type a meaningful name for the file (use “.cpl” as the extension or do not type an extension). Press **Enter**. **Result:** The base radio configuration is saved to the location you indicated. The configuration file will be reloaded later to the replacement transceiver.

Procedure 9-1 How to Replace a Transceiver Module (Continued)

6	For a trunked base radio, disable the channel that is using the transceiver module you will replace. **NOTE** It is recommended that you disable the channel before replacing the module, so that the system does not attribute the loss of channel to a failure. It is not necessary to turn off the power supply for the transceiver module you are replacing, as the modules are designed to be swapped out with the power on. If you choose to turn off the power, set the rocker switch on the front of the associated power supply to the Off (0) position. Disable the base radio as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Service Mode**. **Result:** The base radio is disabled.
7	Disconnect the Ethernet cable from the service port on the transceiver to be replaced.
8	Remove the fan module to gain access to the transceiver module. See Procedure 9-2 for instructions on removing the fan unit. **IMPORTANT** Although the transceiver module is designed to be swapped out without shutting the power off, you should minimize the amount of time that the fan assembly is removed, so the circuitry that remains powered on does not overheat and shut down.
9	Label and disconnect the following cables from the ports on the transceiver, if applicable. • RJ-45 cable from the V.24 port • Mini SCSI cable from the System Connector port • RJ-45 cable from the Microphone port • RJ-9 cable from the Speaker port • RJ-45 cable from the Wireline port
10	Using a T20 bit, loosen the two captive screws on the front of the transceiver module, so that they disengage from the chassis.
11	Using the handle, gently pull the transceiver module straight out, along the guides on which it sits.

Procedure 9-1 How to Replace a Transceiver Module (Continued)

12	Slide in the replacement transceiver module along the guiding rails until it is engaged. A slight push may be needed to engage the module. **Result:** LEDs on the transceiver turn on when it is engaged. **IMPORTANT** If the transceiver module stops well before it is engaged, it is in an incorrect position. Either it is in the wrong slot or it is rotated 180°. The module has a keying feature that prevents it from going all the way into an incorrect slot, or going into the correct slot but rotated 180°. Do not try to force the module.
13	Secure the transceiver module to the chassis with the two captive screws on the front of the module.
14	Reconnect the following cables to the ports on the transceiver, if applicable. • RJ-45 cable from the V.24 port • Mini SCSI cable from the System Connector port • RJ-45 cable from the Microphone port • RJ-9 cable from the Speaker port • RJ-45 cable from the Wireline port
15	Reinstall the fan assembly module. See Procedure 9-2. **NOTE** If you chose to turn off the power, set the rocker switch on the front of the associated power supply to the On (1) position.
16	Connect to the device's DB-9 serial service port using Configuration/Service Software (CSS). See “Connecting Through a Serial Port Link” in the Configuration chapter.
17	Set the **IP Address** and the **BR_CM Pairing Number** for the device. See “How to Set a Devices IP Address in CSS” in the Configuration chapter.
18	Set the Serial Security Services Using CSS. See “How to Set the Serial Services Using CSS” in the Configuration chapter.
19	Disconnect the laptop PC from the transceiver's DB-9 serial port.
20	Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
21	Reconfigure the SNMPv3 user credentials. See “Changing SNMPv3 Configuration and User Credentials Using CSS” in the Configuration chapter.
22	Set the SWDL transfer mode. See “Setting the SWDL Transfer Mode Using CSS” in the Configuration chapter.

Procedure 9-1 How to Replace a Transceiver Module (Continued)

23	Reconfigure for SSH. See Chapter 4, "Configuring SSH for RF Site Devices and VPMs Using CSS" in the *Securing Protocols with SSH* manual or see "Device Security Configuration Remote Access/Login Banner (Ethernet)" in the *CSS Online Help*.
24	Restore the following Clear Protocols parameters in the Remote Access Configuration tab on the Device Security Configuration screen in CSS. Refer to "Device Security Configuration Remote Access/Login Banner (Ethernet)" in the *CSS Online Help*.
25	Update/Verify the DNS, Syslog, and RADIUS Service Configuration. See Chapter 7 of the *Authentication Services* manual.
26	Set the NTP Server Settings. See "NTP Server Settings" in the *CSS Online Help*.
27	Open the Software Download application. **CAUTION** **There is a possibility of a mismatch in software versions when replacing the transceiver module with an on-hand spare. If a mismatch in software versions occurs, this may cause the transceiver to go into a configuration mode of operation with a reason of 'Invalid Software Version'.**
28	Transfer and install the latest base radio software using Software Download as follows: **1.** Select the appropriate ASTRO® 25 system Site Type, and the relevant zone and site information. **2.** Select **Single Device Mode tab** and click **Continue**. **Result:** An informational warning appears. **3.** Click **OK** to continue. **4.** Enter the IP address of the base radio to be programmed and click **Continue**. **5.** In the Upgrade Options window, select **Standard Upgrade** and click **Continue**. **6.** Select either **HPD Base Radio**,**Multisite Base Radio**, or **Conventional Base Radio** for the Application Type. **7.** Select **Transfer and Install** for the Operations Type. **8.** For Software Component, select a configuration fileset from the drop-down list. If the desired configuration fileset needs to be imported: **a.** Go to **File:File Manager:Component Operations/Import Fileset** and browse to the location of the BR fileset. **b.** Select the fileset, click **Generate** to create a new component for the imported fileset. Click **OK**. **9.** Select **Start Operation**.

Procedure 9-1 How to Replace a Transceiver Module (Continued)

	Result: The software is transferred and installed on to the device. This takes several minutes to complete. When completed, the two progress bars on the Transfer and Install window display “100%” and a completion message displays in the Transfer message box.
29	Reload the base radio configuration file on to the new base radio, as follows: **1.** From the CSS File menu, select **Open**. Locate and open the previously saved configuration file for the base radio. **NOTE** If you were not able to back up the base radio configuration from the previous base radio, you can use the configuration from your system build book or use the default base radio configuration file. Specific settings for the base radio must still be configured. See the *CSS Online Help* for GTR 8000 Base Radio for detailed configuration instructions. If the base radio is part of a Power Efficiency Package, make sure the base radio Tx Power Out in the CSS is limited to 50 W. **2.** Click **OK** on the Properties window. **3.** From the File menu, select **Write Configuration To Device**. Click **OK** on the confirmation message. **Result:** The configuration from the file you selected is loaded into the base radio. Communication with the base radio is not available until the reset is complete.
30	For a trunked base radio, enable the base radio as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The base radio is enabled.
31	Disconnect the laptop PC from the transceiver.
32	Perform a centralized software download and installation. **NOTE** For a conventional base radio, a site mode download is not available. **1.** Connect the PC Ethernet to the local LAN. **2.** Initiate a site mode download to the site controller to make sure all devices are on the correct software version and the same VLAN.
33	Disconnect the PC Ethernet from the local LAN.

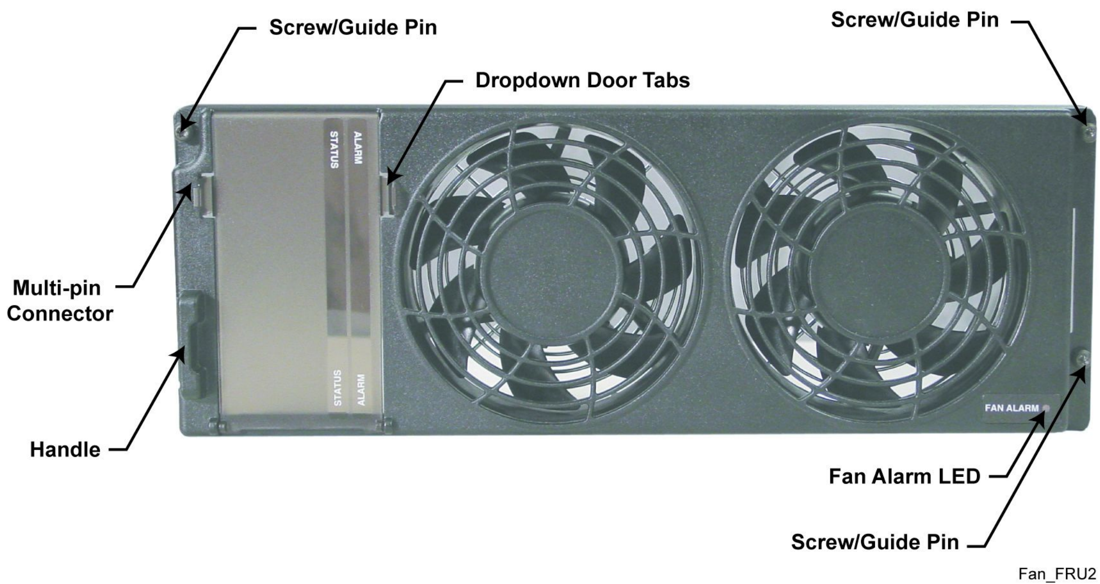
Procedure 9-1 How to Replace a Transceiver Module (Continued)

34	On systems with SNMPv3 enabled, enable passphrase information. For procedures to enable passphrases, refer to the *SNMPv3* manual.
35	On systems with MAC Port locking, disable the locking and then re-enable the locking with the MAC address of the base radio. The device being replaced may be connected to an Ethernet port on a switch which implements MAC Port locking (HP switch or site controller). If so, the Ethernet switch port will need to be unlocked and relocked to the MAC address of the replacement device. See the *Ethernet Port Security* volume for instructions on how to disable and enable MAC port locking. **NOTE** Following the device restoration, if it was connected to an HP switch port, the HP switch port may have been disabled due to an unexpected MAC address. If so, re-enable the port on the HP switch.
36	Replace the transceiver in the UNC. See Chapter 4, “Replacing a Device” in the *Unified Network Configurator* manual.
37	Discover the base radio in the UEM. See the *Unified Event Manager* manual.
38	Verify that the transceiver module is operating properly: • The Status LED on the front of the transceiver is green. • Proper operation is confirmed using software tools, such as UEM, and the Transmitter Metering Screen in Configuration/Service Software (CSS).

Removing/Replacing the Fan Module

See Procedure 9-2 for instructions on replacing the fan module. This procedure can also be used to remove the fan module in order to replace the modules it covers (transceiver or power amplifier modules). Figure 9-3 shows the fan module FRU.

Figure 9-3 Fan Module (Front View)



IMPORTANT

The fan module is designed to be swapped out without shutting the power off. However, you should minimize the amount of time before the new fan is operational, so the base radio modules do not overheat and shut down.

WARNING

When removing a fan module care should be taken to avoid contacting moving fan blades before and after removal with tools, hands, or other objects. If you are removing the fan module to access or replace the modules behind it, it is recommended that you turn off the equipment power and allow the modules to cool before performing any work as the surfaces of the modules can be extremely hot.

Procedure 9-2 How to Remove/Replace a Fan Module

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	Using a T20 bit, loosen the three captive screws on the front of the fan module, so that they disengage from the chassis.
3	Using the handle on one end and the edge on the other side, gently pull the fan assembly straight out to disengage the connector.

Procedure 9-2 How to Remove/Replace a Fan Module (Continued)

4	**NOTE** All fan modules are delivered from the factory for dual fan operation. If the base radio/receiver is part of a Power Efficiency Package, the fan must be converted for Single Fan Operation. Also, make sure the Tx Power Out in the CSS is limited to 50 W. Convert for Single Fan Operation: **1.** Lift the connected harness out of the rubber retainer. **2.** Disconnect the connector harness. **3.** Place each connector end into the individual pockets of the rubber retainer.
5	Using the guide pins and the connector on the back of the new fan module, push the new fan module into place until it feels secure.
6	Tighten the three captive screws. Torque to 17 ± 2 in-lb.
7	Verify that the fan assembly is operating properly, and that the fan's Alarm LED is off. You can also use software tools, such as Unified Event Manager or CSS to verify the status of the equipment.

Replacing a Power Supply

The power supply is a field replaceable unit (FRU). Figure 9-4 identifies the power supply FRU. See Procedure 9-3 for instructions on replacing the power supply.

Figure 9-4 Power Supply

HPD_Power_Supply_FRU.jpg

NOTE

The power supply output is directly mapped to a PA/transceiver combination. Removal of a power supply will result in a loss of the associated transmit channel until the replacement power supply is inserted and turned ON.
It is recommended that you disable the channel before replacing the module, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager, or the Configuration/Service Software (CSS).

WARNING

The Power Supply module contains dangerous voltages which can cause electrical shock to people or damage to equipment.

Procedure 9-3 How to Replace a Power Supply

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	Disable the channel that is using the power supply module you will replace. **NOTE** It is recommended that you disable the channel before replacing the module, so that the system does not attribute the loss of channel to a failure.

Procedure 9-3 How to Replace a Power Supply (Continued)

	Disable the base radio as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Service Mode**. **Result:** The base radio is disabled.
3	Push the power rocker switch to Off (0) on the power supply unit.
4	Using a T20 bit, loosen the two captive screws on the front of the power supply, so that they disengage from the chassis. **WARNING** **It is recommended that you let the power supply module cool before performing the following step, which will expose surfaces of the module that can be extremely hot.**
5	Pull on the metal handle to disengage the power supply from the backplane, and remove it completely from the chassis.
6	Slide the FRU power supply into place, pushing gently until it seats.
7	Tighten the two captive screws on the front of the power supply.
8	Turn the power button to On, and verify that the power supply is operating properly. • The power supply Status LED is green. • The power supply Alarm LED is off. • The power supply Fan LED is off. • Proper operation is confirmed using software tools, such as Unified Event Manager, and the Power Supply Metering Screen in Configuration/Service Software (CSS).
9	Enable the base radio as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Normal Mode**. **Result:** The base radio is enabled.

Replacing a Power Supply Fan

The power supply fan is a field replaceable units (FRU).

NOTE

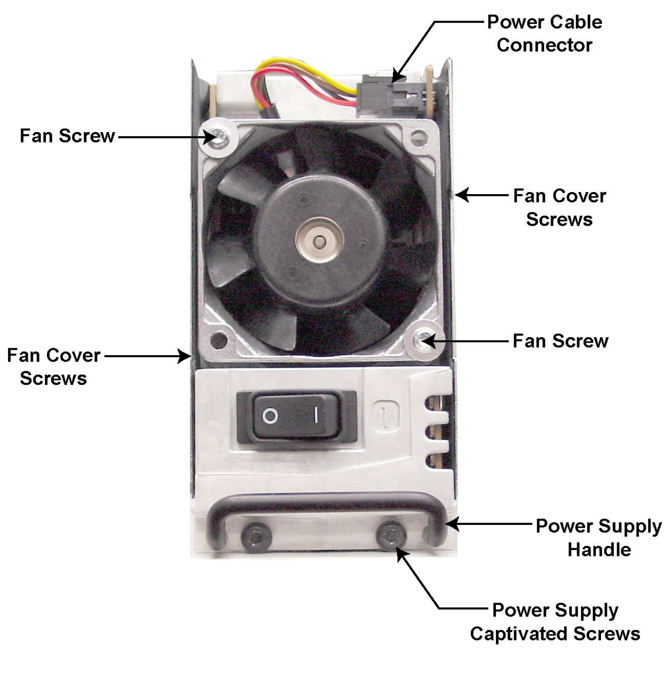
Replacing the power supply fan requires that the entire power supply module be removed. The power supply output is directly mapped to a PA/transceiver combination. Removal of a power supply will result in a loss of the associated transmit channel until the replacement power supply is inserted and turned ON.
It is recommended that you disable the channel before replacing the module, so that the system does not attribute the loss of channel to a failure. You can disable a channel using both the Unified Event Manager or the Configuration/Service Software (CSS).

Figure 9-5 shows the power supply fan installed in a power supply. See Procedure 9-4 for instructions on replacing the power supply fan.

WARNING

The Power Supply module contains dangerous voltages which can cause electrical shock to people or damage to equipment.

Figure 9-5 Power Supply Fan



Procedure 9-4 How to Replace a Power Supply Fan

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	Disable the channel that is using the power supply fan you will replace. **NOTE** It is recommended that you disable the channel before replacing the module, so that the system does not attribute the loss of channel to a failure. Disable the base radio as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The base radio is disabled.
3	Set the rocker switch on the front of the power supply to Off (0) .
4	Using a T20 bit, loosen the two captive screws on the front of the power supply module, so that they disengage from the chassis.
5	Pull on the metal handle to disengage the power supply from the backplane, and remove it completely from the chassis.
6	Remove the black fan cover from the power supply module **1.** Using a T15 bit, remove the 4 screws that connect the cover to the sides of the power supply module. **2.** Slide the cover off (tilting the top edge out and lifting the bottom edge above the power supply handle).
7	Disconnect the power cable located above the fan.
8	Remove the two screws that secure the fan to the power supply.
9	Remove the fan and insert the new fan.
10	Secure the fan to the power supply with the two screws.
11	Attach the power cable for the fan to the connection on the power supply.
12	Replace the black fan cover: **1.** Slide the cover on, tilting the bottom edge in, past the power supply handle. **2.** Using a T15 bit, insert and tighten the 4 screws that connect the cover to the sides of the power supply module.
13	Slide the FRU power supply into place, pushing gently until it seats.
14	Tighten the two captive screws on the front of the power supply module.

Procedure 9-4 How to Replace a Power Supply Fan (Continued)

15	Turn the power button to On, and verify that the power supply is operating properly. • The power supply Status LED is green. • The power supply Alarm LED is off. • The power supply Fan LED is off and the fan is operating. • Proper operation is confirmed using software tools, such as Unified Event Manager, and the Power Supply Metering Screen in Configuration/Service Software (CSS).
16	Enable the base radio as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The base radio is enabled.

Replacing a Power Amplifier

Figure 9-6 shows the power amplifier FRU module. Figure 9-7 shows the captive screws that secure the power amplifier module to the chassis in the GTR 8000 Base Radio.

Figure 9-6 Power Amplifier Module

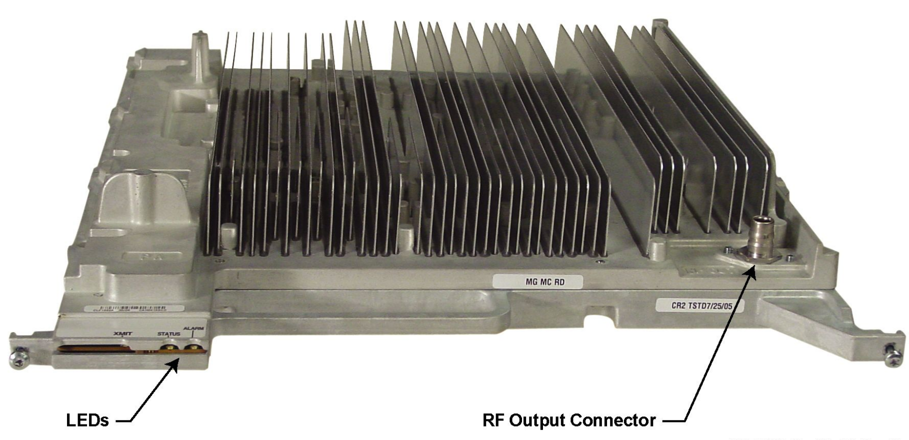
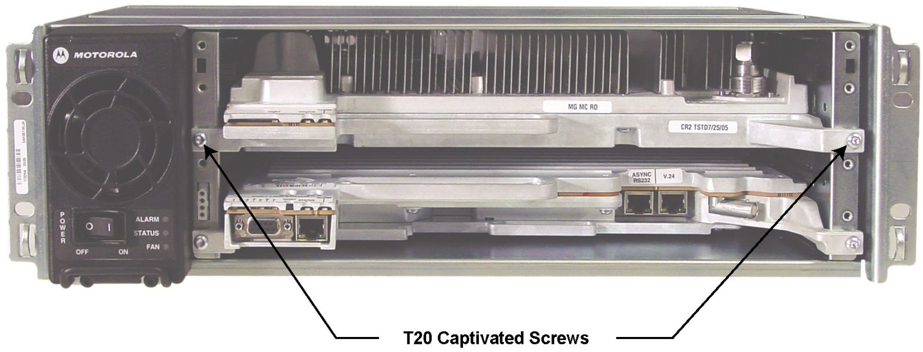


Figure 9-7 Captive Screws



GTR8000_PA_NonXS_NoFan1

Procedure 9-5 How to Replace a Power Amplifier

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	If the base radio is not operational, skip to step 4.
3	Disable the channel that is using the base radio associated with the power amplifier module you will replace. **NOTE** It is recommended that you disable the channels before replacing the module, so that the system does not attribute the loss of channel to a failure. You can disable a channel using the Configuration/Service Software (CSS). It is not necessary to turn off the power supply for the power amplifier module you are replacing, as the power amplifier modules are designed to be swapped out with the power on. If you choose to turn off the power, set the rocker switch on the front of the associated power supply to the Off (0) position. Disable the base radio as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The base radio is disabled.

Procedure 9-5 How to Replace a Power Amplifier (Continued)

4 Remove the fan unit to gain access to the power amplifier module. See Procedure 9-2 for instructions on removing the fan unit.

IMPORTANT

The power amplifier module is designed to be swapped out without shutting the power off. However, you should minimize the amount of time that the fan is removed, so the circuitry that remains powered on does not overheat and shut down.

CAUTION

It is recommended that you let the power amplifier module cool before performing the following step, which will expose surfaces of the module that can be extremely hot.

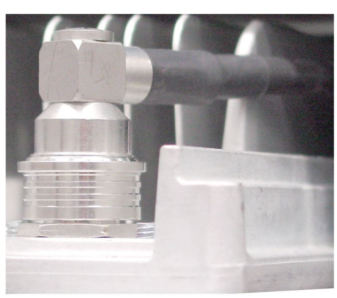
5 Using a T20 bit, loosen the two captive screws on the front of the power amplifier module so that they disengage from the chassis.

6 Remove the RF output QN connector from the front of the power amplifier module, as follows.

1. Pull the power amplifier out of the chassis far enough so that the QN (quick-N) RF output connector is accessible.

2. Disconnect the cable from the power amplifier.

Figure 9-8 GTR 8000 Power Amplifier RF Cable (Front)



GTR8000_XCVR_RFCable_On

7 Using the handle, gently pull the power amplifier module straight out, along the guides on which it sits.

8 Reconnect the RF cable to the RF output QN connector on the front of the power amplifier module, as follows:

1. While holding the RF cable, slide in the replacement power amplifier module along the guiding rails until the RF cable connector can reach the RF connection on the front of the module.

2. Push the RF cable's connector on to the module's connector until it snaps securely into place.

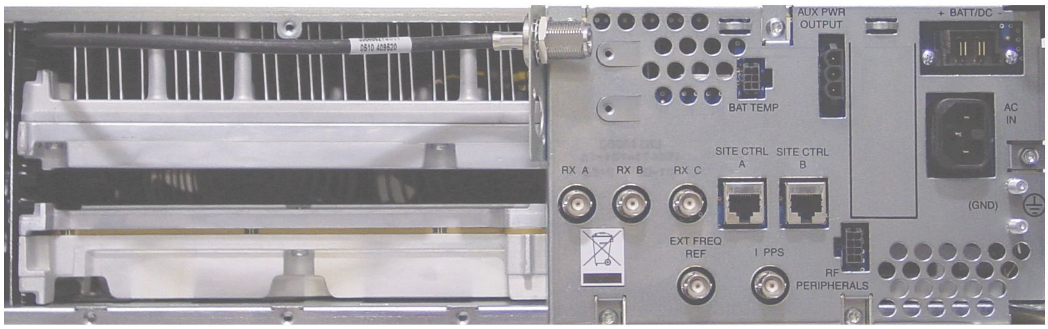
Procedure 9-5 How to Replace a Power Amplifier (Continued)

9	Slide in the replacement power amplifier module until it engages with the backplane. A slight push may be needed to engage the module. **IMPORTANT** If the power amplifier module stops well before it is engaged, it is in an incorrect position. Either it is in the wrong slot or it is rotated 180°.
10	Secure the power amplifier module to the chassis with the two captive screws on the front of the module.
11	Reinstall the fan unit. See Procedure 9-2. **NOTE** If you chose to turn off the power, set the rocker switch on the front of the associated power supply to the On (1) position.
12	Verify that the power amplifier is operating properly. • The power amplifier Status and Transmit LEDs are green. • The Alarm LED is off. • Proper operation is confirmed using software tools, such as Unified Event Manager, and the Transmitter Metering Screen in Configuration/Service Software (CSS).
13	Enable the base radio as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The base radio is enabled.

Replacing the GTR 8000 Base Radio Backplane

In a GTR 8000 Base Radio, the “backplane” is the circuit board at the rear of the card cage which connects the power supply, transceiver and power amplifier. Figure 9-9 shows the metal cover that must be removed to access the backplane. See “Connections – Rear (Integrated Voice & Data)” and “Connections – Rear (HPD) in the Installation chapter for the ports and cables that must be disconnected in order to remove the cover.

Figure 9-9 GTR 8000 Base Radio Showing Connections to Backplane Through Backplane Cover



GTR8000_base_radio_rear

Follow Procedure 9-6 to replace the backplane in a GTR 8000 Base Radio.

NOTE

The procedure assumes the following service access clearances:

- At least 60.96cm (2 ft) access at the rear of the rack, or
- At least 60.96cm (2 ft) access on one side of the rack, and at least 6 inches at the rear of the rack

Procedure 9-6 How to Replace a GTR 8000 Base Radio Backplane

1	Wear an electrostatic discharge (ESD) strap and connect its cable to a verified good ground. Be sure to wear this strap throughout this procedure to prevent ESD damage to any components.
2	If the base radio is not operational, skip to step 4.
3	Disable the channel that is using the base radio with the backplane you will replace. **NOTE** Powering down the base radio will cause any affiliated subscribers to relocate to another channel at the site or another channel at an adjacent site. It is recommended that you disable the channel before powering down, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager or the Configuration/Service Software (CSS).

Procedure 9-6 How to Replace a GTR 8000 Base Radio Backplane (Continued)

	Disable the base radio as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See "Connecting Through an Ethernet Port Link" in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The base radio is disabled.
4	Push the power rocker switch to Off (0) on the power supply unit.
5	Label, then disconnect all cables from the base radio backplane. **NOTE** There is an RF output cable from the power amplifier which connects through a metal bulkhead to the left of the backplane. This does not need to be disconnected. However, to access the backplane screw behind the metal bulkhead, using a T20 bit you must remove the two screws securing the bulkhead to the inner chassis at the left of the backplane.
6	Disconnect the RJ-45 cable from the V.24 port on the transceiver, if applicable.
7	Disconnect the mini SCSI cable from the System Connector port on the transceiver, if applicable.
8	Remove the power supply module from the chassis as follows: • Using a T20 bit, loosen the two captive screws on the front of the power supply, so that they disengage from the chassis. **WARNING** **It is recommended that you let the power supply module cool before performing the following step, which will expose surfaces of the module that can be extremely hot.** • Pull on the metal handle to disengage the power supply module from the backplane, and remove it completely from the chassis.
9	Remove the fan assembly unit to gain access to the transceiver and power amplifier modules. See Procedure 9-2 for instructions on removing the fan unit.

Procedure 9-6 How to Replace a GTR 8000 Base Radio Backplane (Continued)

10	Disengage the transceiver module and the power amplifier from the backplane as follows: • Using a T20 bit, loosen the two captive screws on the front of each module, so that they disengage from the chassis. **WARNING** **It is recommended that you let the power amplifier module cool before performing the following step, which will expose surfaces of the module that can be extremely hot.** • Using their handles, gently pull the modules until they disengage from the backplane.
11	Using a T20 bit, remove the screw that secures the tab on the right EMI spring panel. See Figure 9-11. **NOTE** Removing the left EMI spring panel is optional.
12	Carefully slide the EMI spring panel forward, noting how the panel is affixed onto the power supply guide rail. The panel does not need to be completely removed.
13	Remove the fan cable from the backplane, from the front of the chassis, with the backplane still secured to the chassis, as follows: **1.** Follow the fan cable with your hand from its connector at the front of the chassis to its connection to the backplane, through the card cage section from which you removed the power supply module. **2.** Remove the fan cable's multi-pin connector from the backplane. **SUGGESTION** Squeeze the top and bottom of the connector and pull the connector straight out from the backplane.
14	Remove the five screws, using a T20 bit, that secure the metal backplane cover and the backplane circuit board to the rear of the base radio chassis.
15	Remove the metal backplane cover and the backplane circuit board.
16	Place the new backplane circuit board in the same location and orientation as the one that you removed.

Procedure 9-6 How to Replace a GTR 8000 Base Radio Backplane (Continued)

17

IMPORTANT

Before securing the five screws into the backplane circuit board and backplane cover, all screws should be started first before they are seated and fully secured.

Secure the new backplane circuit board and the backplane cover to the rear of the base radio chassis with the five screws previously removed. Torque to 18 +/- 2 in.-lbs.

18

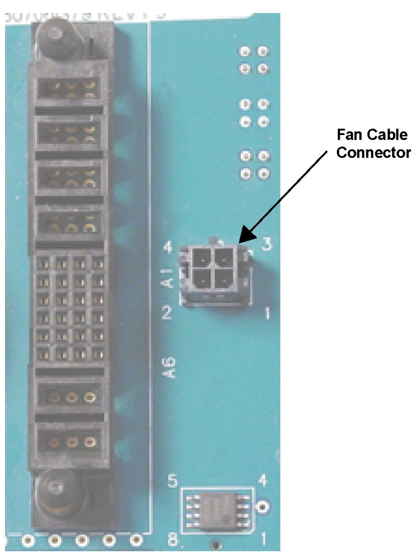
Reinstall the metal bulkhead that holds the RF output cable from the power amplifier, using the two screws previously removed to secure it to the inner chassis at the left of the backplane.

19

Connect the fan cable to the new backplane, from the front of the chassis, with the backplane secured to the chassis, as follows:

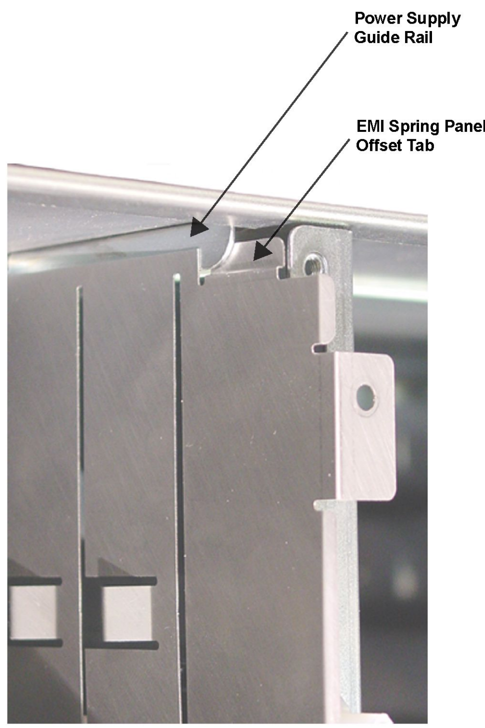
1. Locate the port in the new backplane for the fan cable's multi-pin connector.
2. Follow the fan cable with your hand from its connector at the front of the chassis to the connector at the other end of the cable.
3. Push the fan cable's multi-pin connector, with the tab up, into the correct location in the backplane. See Figure 9-10.

Figure 9-10 Fan Cable Connector



GTR_GCP_Fan_Cable_Connector

Procedure 9-6 How to Replace a GTR 8000 Base Radio Backplane (Continued)

20	Slide the EMI spring panel back into the cabinet, making sure that the offset tabs on the panel are to the right (inside) of the power supply guide rail, making sure that the panel does not catch on the fan cable. See Figure 9-11. **Figure 9-11** EMI Spring Panel Guide Rail Alignment 
21	Reinstall the screw into the EMI spring panel tab.
22	Slide the transceiver and power amplifier modules into the new backplane. A slight push may be needed to engage the modules.
23	Reconnect the RJ-45 cable to the V.24 port on the transceiver, if applicable.
24	Reconnect the mini SCSI cable to the System Connector port on the transceiver, if applicable.
25	Secure the transceiver and power amplifier modules to the chassis with the two captive screws on the front of each module.
26	Reinstall the fan assembly unit. See Procedure 9-2.
27	Slide the power supply into the chassis, pushing gently until it seats in the new backplane. **NOTE** If the power supply does not seat properly, remove it and adjust the EMI spring panel properly against the mounting flange.

Procedure 9-6 How to Replace a GTR 8000 Base Radio Backplane (Continued)

28	Tighten the two captive screws on the front of the power supply.
29	Reconnect all cables at the rear of the base radio.
30	Set the power supply rocker switch to On (1).
31	Verify that the LEDs indicate the modules you removed and reinstalled are operational. • The Status LEDs are green. • The Alarm LEDs are off. • The power supply Fan LED is off.
32	Enable the channel as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The channel is enabled.
33	Re-configure the Security Settings into the Backplane. See “How to Set the Serial Services Using CSS” in the Configuration chapter.
34	Verify proper operation using software tools, including: • Unified Event Manager. • Configuration/Service Software (CSS).

Replacing a Preselector Filter

Figure 9-12, Figure 9-13, and Figure 9-14) shows the preselector filters.

Figure 9-12 Preselector Filter (700/800 MHz)

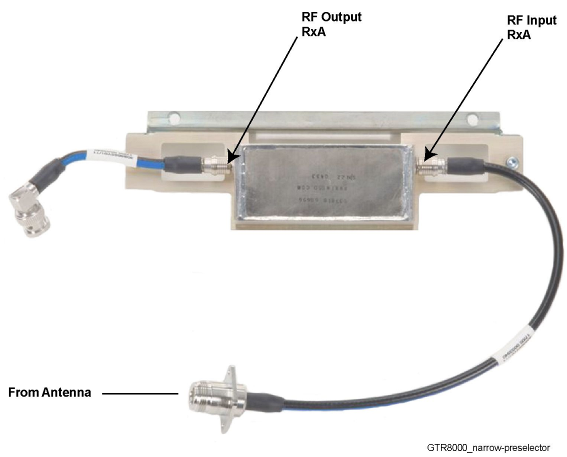


Figure 9-13 Preselector Filter (UHF)

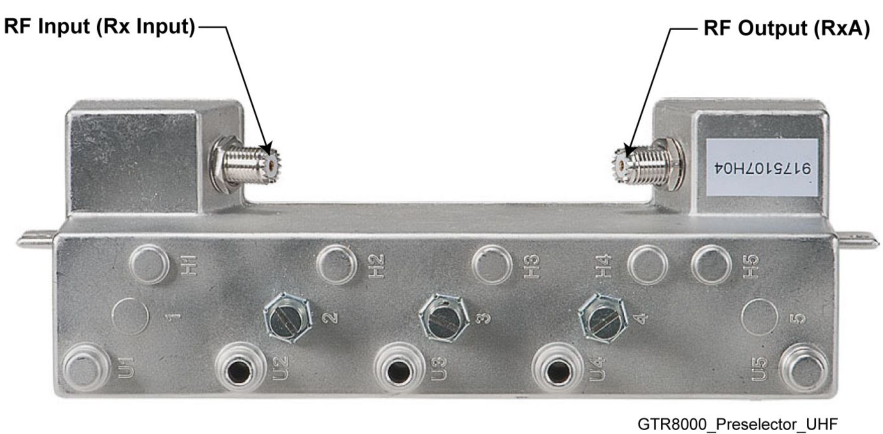
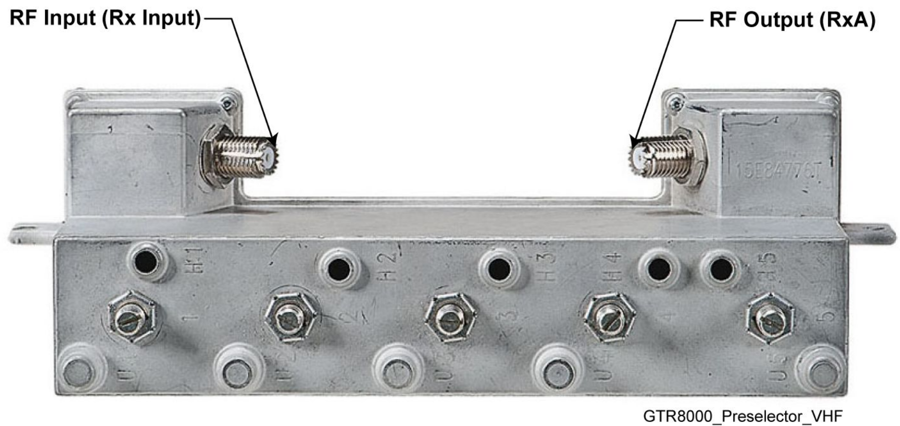


Figure 9-14 Preselector Filter (VHF)



IMPORTANT

You can replace a preselector filter without shutting the power down.

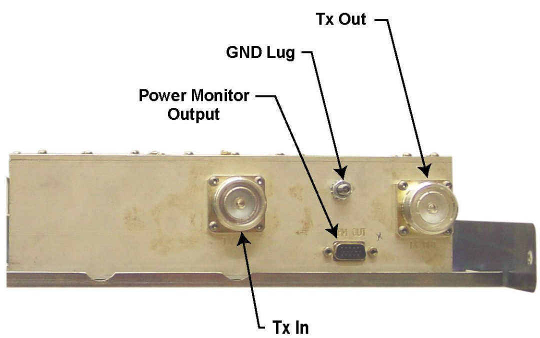
Procedure 9-7 How to Replace a Preselector Filter

1	Wear an electrostatic discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	Remove the preselector from the base radio, as follows: **1.** Remove the two screws which secure the preselector to the flange of the base radio using T20 bit. **2.** Label and disconnect the left and right QMA cables from the front of the preselector.
3	Install the preselector to the base radio, as follows: **1.** Secure the slide rail to the base radio flange using the two screws which were previously removed. **2.** Reconnect the left and right QMA cables to the preselector. **3.** Tune the preselector. See the Optimization chapter.
4	Verify that the system is operating properly using fault management software, including: • Unified Event Manager. • Transmitter Metering Screen in Configuration/Service Software (CSS).

Replacing Transmit Filters (700/800 MHz)

Figure 9-15 shows the transmit filter installed on a tray.

Figure 9-15 Transmit Filter (700/800 MHz)



GTR8000_RFDS_XS_TXFilter_Front1

IMPORTANT

When using Procedure 9-8 to replace or remove the transmit filter, the warning applies and you must power down the site before starting the replacement procedure if the entire site is connected to the Transmit filter being removed. Powering down the site will cause any affiliated subscribers to relocate to another channel at an adjacent site. It is recommended that you disable the channels before powering down, so that the system does not attribute the loss of channel to a failure. You can disable a channel using the Unified Event Manager, or the Configuration/Service Software (CSS).

WARNING

Shock hazard. The GTR 8000 Base Radio contains dangerous voltages which can cause severe electrical shock or damage to equipment. Set the rocker switches on the front of the associated power supplies to the off position before servicing this component in the base radio.

Procedure 9-8 How to Replace Transmit Filters (700/800 MHz)

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

Procedure 9-8 How to Replace Transmit Filters (700/800 MHz) (Continued)

2	Disable all channels at the site that are using the transmit filter module you will replace. **NOTE** Using Unified Event Manager or CSS to disable the channel ensures that calls in progress complete before the channel shuts down. Disable the channels as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The channels are disabled.
3	Set the rocker switches on the front of the power supplies to the OFF (0) position.
4	Remove the transmit filter tray from the rack, as follows: **1.** Label and disconnect the Tx input, antenna output, and ground cables from the transmit filter. **2.** Using a T30 bit, remove the two screws which secure the tray to the rack. **3.** Slide the tray out the front of the rack.
5	Remove the transmit filter from the tray, by removing the T20 screws that attach it to the tray.
6	Install the new transmit filter in the tray, as follows: **1.** Place the new transmit filter in the tray, in the same location and orientation as the module that you removed. **2.** Secure the replacement transmit filter to the tray, using the T20 screws you previously removed.
7	Re-install the transmit filter tray in the rack, as follows: **1.** Slide the tray in the front of the rack. **2.** Using a T30 bit, secure the tray to the rack with the two screws you previously removed. **3.** Reconnect the Tx input, Antenna output, and ground cables to the transmit filter.
8	Set the rocker switches on the front of the power supplies to the ON (1) position.
9	Enable the channels as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The channels are enabled.

Replacing the Dual Circulator/Isolator Modules

For a GTR 8000 Base Radio, the following RFDS modules are assembled in a tray:

- External Dual Circulator/Isolator
- Circulator Load (a module that is connected directly to the External Dual Circulator module)
- Low Pass/Harmonic Filter

Figure 9-16 and Figure 9-17 show these modules installed on a tray.

Figure 9-16 External Dual Circulator/Isolator Tray (700/800 MHz)

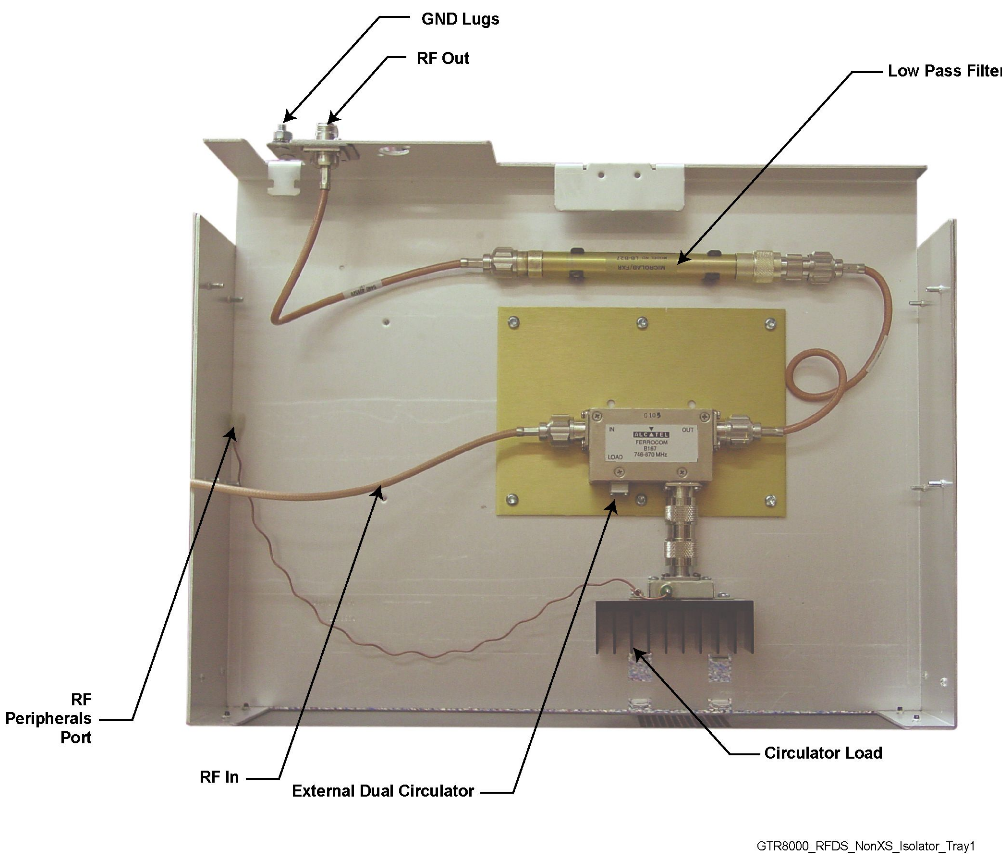
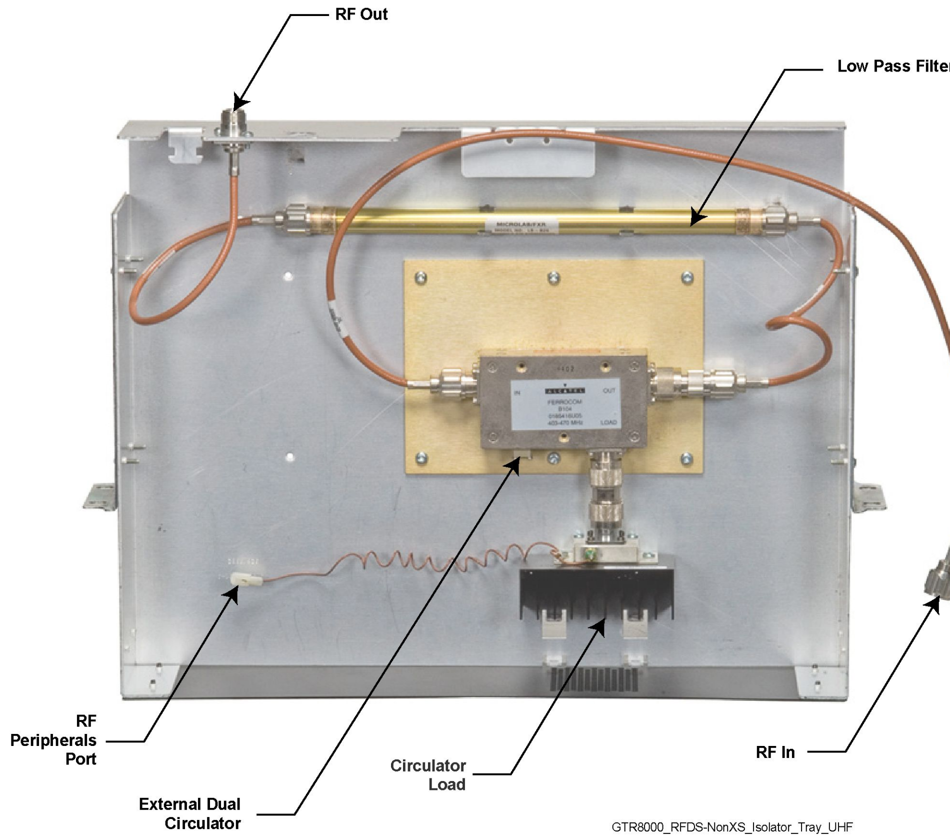


Figure 9-17 External Dual Circulator/Isolator Tray (UHF)



These modules can be replaced individually, or if you order them together, you may receive the modules already secured to a tray. Procedure 9-9 provides instructions for replacing individual modules or the entire tray.

WARNING

Shock hazard. The GTR 8000 Base Radio contains dangerous voltages which can cause electrical shock or damage to equipment. Set the power supply switches for the affected equipment to the Off (0) position when servicing this component in the system.

IMPORTANT

Powering down the base radio will cause any affiliated subscribers to relocate to another channel at the site or another channel at an adjacent site. It is recommended that you disable the channel before powering down, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager or the Configuration/Service Software (CSS).

Procedure 9-9 How to Replace the Dual Circulator/Isolator Modules

<table>
<tr><td>1</td><td colspan="2">Wear an electrostatic discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.</td></tr>
<tr><td>2</td><td colspan="2">Set the rocker switch on the front of the power supply to the OFF (0) position.</td></tr>
<tr><td>3</td><td colspan="2">Disable the channel as follows:
1. Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter.
2. Open CSS and select Test & Measurement Screen from the Service menu.
3. Click Change to Service Mode.
Result: The channel is disabled.</td></tr>
<tr><td>4</td><td colspan="2">Remove the filter tray from the rack, as follows:
1. Label and disconnect the RF input, RF output, and ground cables from the tray.
2. Disconnect the Circulator Load temperature cable at the inline connector (which disconnects it from the cable leading to the RF Peripherals port on the base radio backplane).
3. Using a T30 bit, remove the two screws which secure the tray to the rack.
4. Slide the tray out the front of the rack.</td></tr>
<tr><td rowspan="2">5</td><td>IF:</td><td>THEN:</td></tr>
<tr><td>You are replacing an individual External Dual Circulator/Isolator module...</td><td>1. Label and disconnect the RF input and RF output cables from the External Dual Circulator module.
2. Unscrew the connector that secures the Circulator Load to the External Dual Circulator module.
3. Remove the screws that secure the circulator baseplate to the tray.
4. Remove the circulator module including the circulator load module that extends beyond the baseplate.
5. Place the new External Dual Circulator module in the tray in the same location and orientation as the module you are replacing.
6. Secure the new External Dual Circulator module baseplate to the tray using the screws previously removed.
7. Connect the RF input and RF output cables to the new External Dual Circulator module.
8. Connect the Circulator Load to the External Dual Circulator module.
9. Proceed to the next step, using the existing tray.</td></tr>
</table>

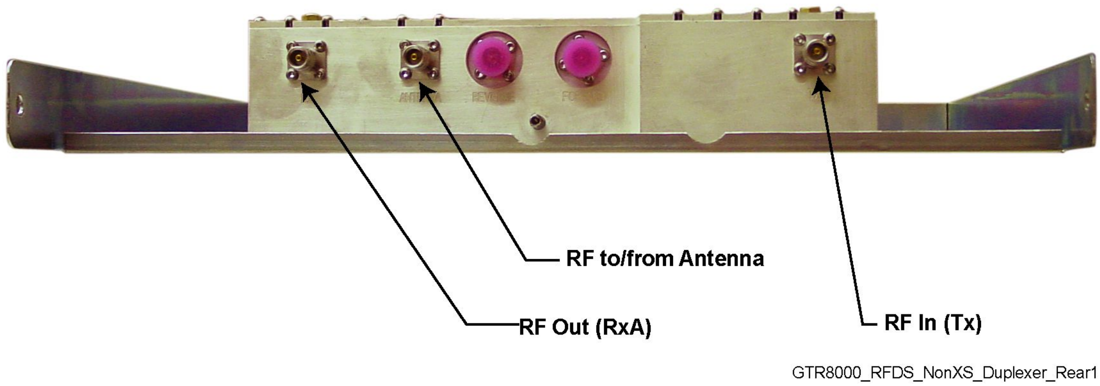
Procedure 9-9 How to Replace the Dual Circulator/Isolator Modules (Continued)

	You are replacing an individual Circulator Load...	**1.** Unscrew the connector that secures the Circulator Load to the External Dual Circulator module. **2.** Remove the Circulator Load module. **3.** Place the new Circulator Load module on the tray in the same position and orientation as the module you removed. **4.** Secure the new Circulator Load to the External Dual Circulator module by tightening the connector. **5.** Connect the Circulator load cable to the RF Peripherals port on the base radio backplane. **6.** Proceed to the next step, using the existing tray.
	You are replacing an individual Low Pass/Harmonic Filter module...	**1.** Label and disconnect the RF input and RF output cables from the Low Pass/Harmonic Filter module. **2.** Pull up firmly to release the Low Pass Filter module from the two semi-circular clips holding it in place. **3.** Insert the new Low Pass Filter module into the semi-circular clips using the same orientation as the module you are replacing. **4.** Connect the RF input and RF output cables to the new Low Pass/Harmonic Filter module. **5.** Proceed to the next step, using the existing tray.
	You are replacing the entire tray including all of its modules.	**1.** Proceed to the next step, using the replacement tray.
6	Install the tray in the rack: **1.** Slide the tray into the appropriate location through the front of the rack. **2.** Secure the slide rail to the rack using the two screws which were previously removed. **3.** Reconnect the RF input, RF output, and ground cables. **4.** Reconnect the Circulator Load temperature cable at the inline connector (which connects it to the cable leading to the RF Peripherals port on the base radio backplane).	
7	Set the rocker switch on the front of the power supply to the On (1) position.	
8	Enable the channel as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The channel is enabled.	
9	Verify that the base radio is operating properly using fault management software, including Unified Event Manager and Transmitter Metering Screen in Configuration/Service Software (CSS).	

Replacing a Duplexer (700/800 MHz)

Figure 9-18 shows the duplexer installed on a tray for 700/800 MHz.

Figure 9-18 Duplexer Module (700/800 MHz)



To replace the duplexer, perform Procedure 9-10.

WARNING

Shock hazard. The GTR 8000 Base Radio contains dangerous voltages which can cause electrical shock or damage to equipment. Set the power supply switches for the affected equipment to the Off (0) position when servicing this component in the base radio.

IMPORTANT

Powering down the base radio will cause any affiliated subscribers to relocate to another channel at the site or another channel at an adjacent site. It is recommended that you disable the channel before powering down, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager or the Configuration/Service Software (CSS).

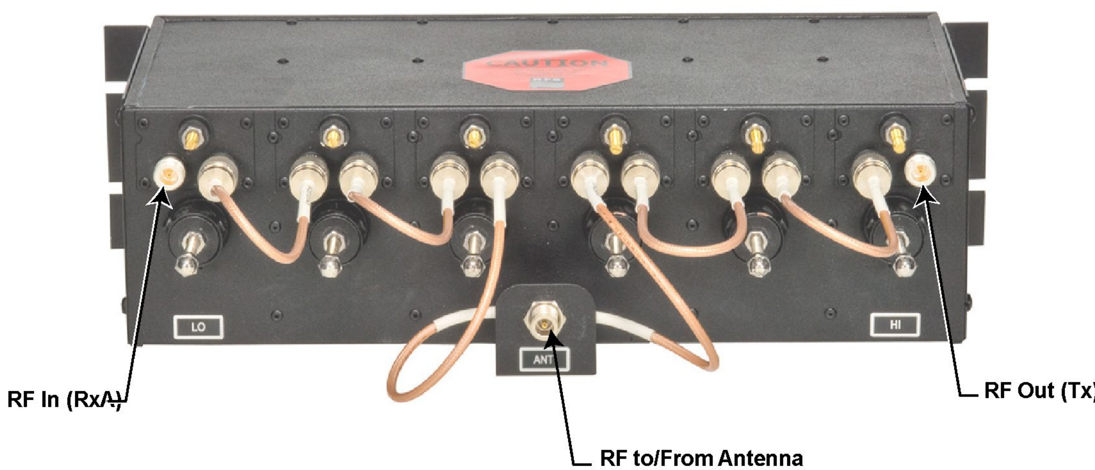
Procedure 9-10 How to Replace a Duplexer (700/800 MHz)

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	Disable the channel that is using the base radio in the system with the duplexer module you will replace. Disable the channel as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See "Connecting Through an Ethernet Port Link" in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The channel is disabled.
3	Set the rocker switch on the front of the power supply to the OFF (0) position.
4	Remove the duplexer tray from the rack, as follows: **1.** Label and disconnect the Rx output, Tx input, antenna output, and ground cables from the duplexer. **2.** Using a T30 bit, remove the two screws which secure the tray to the rack. **3.** Slide the tray out the front of the rack.
5	Remove the duplexer from the tray, by removing the T20 screws that attach it to the tray.
6	Install the new duplexer in the tray, as follows: **1.** Place the new duplexer in the tray, in the same location and orientation as the module that you removed. **2.** Secure the replacement duplexer to the tray, using the T20 screws you previously removed.
7	Re-install the duplexer tray in the rack, as follows: **1.** Slide the tray in the front of the rack. **2.** Using a T30 bit, secure the tray to the rack with the two screws you previously removed. **3.** Reconnect the Rx output, Tx input, Antenna output, and ground cables to the duplexer.
8	Set the rocker switch on the front of the power supply to the ON (1) position.
9	Enable the channel as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The channel is enabled.

Replacing a Duplexer (UHF)

Figure 9-19 shows the duplexer for UHF.

Figure 9-19 Duplexer Module (UHF)



GTR 8000 Duplexer UHF

To replace the duplexer, perform Procedure 9-11.

WARNING

Shock hazard. The GTR 8000 Base Radio contains dangerous voltages which can cause electrical shock or damage to equipment. Set the power supply switches for the affected equipment to the Off (0) position when servicing this component in the base radio.

IMPORTANT

Powering down the base radio will cause any affiliated subscribers to relocate to another channel at the site or another channel at an adjacent site. It is recommended that you disable the channel before powering down, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager or the Configuration/Service Software (CSS).

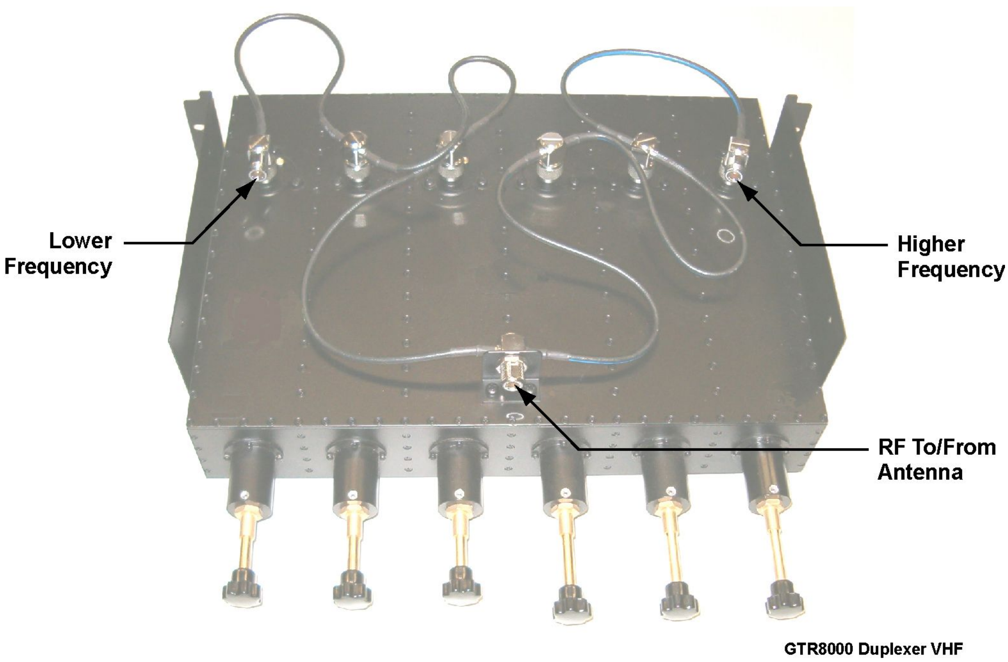
Procedure 9-11 How to Replace a Duplexer (UHF)

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	Disable the channel that is using the base radio in the system with the duplexer module you will replace. Disable the channel as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See "Connecting Through an Ethernet Port Link" in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The channel is disabled.
3	Set the rocker switch on the front of the power supply to the OFF (0) position.
4	Remove the duplexer from the base radio, as follows: **1.** Label and disconnect the Rx output, Tx input, antenna output, and ground cables from the duplexer. **2.** Remove the four screws which secure the duplexer to the rack using T20 bit.
5	Install the duplexer to the rack, as follows: **1.** Secure the duplexer to the rack using the four screws which were previously removed. **2.** Reconnect the Rx output, Tx input, antenna output, and ground cables from the duplexer.
6	Set the rocker switch on the front of the power supply to the ON (1) position.
7	Enable the channel as follows: **1.** Open CSS and select **Mode Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The channel is enabled.

Replacing a Duplexer (VHF)

Figure 9-20 shows the duplexer for VHF.

Figure 9-20 Duplexer Module for IV&D (VHF)



To replace the duplexer, perform Procedure 9-12.

WARNING

Shock hazard. The GTR 8000 Base Radio contains dangerous voltages which can cause electrical shock or damage to equipment. Set the power supply switches for the affected equipment to the Off (0) position when servicing this component in the base radio.

IMPORTANT

Powering down the base radio will cause any affiliated subscribers to relocate to another channel at the site or another channel at an adjacent site. It is recommended that you disable the channel before powering down, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager or the Configuration/Service Software (CSS).

Procedure 9-12 How to Replace a Duplexer (VHF)

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.

Procedure 9-12 How to Replace a Duplexer (VHF) (Continued)

2	Disable the channel that is using the base radio in the system with the duplexer module you will replace. Disable the channel as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The channel is disabled.
3	Set the rocker switch on the front of the power supply to the OFF (0) position.
4	Remove the duplexer from the base radio, as follows: **1.** Label and disconnect the Rx output, Tx input, antenna output, and ground cables from the duplexer. **2.** Remove the four screws which secure the duplexer to the rack using T20 bit.
5	Install the duplexer to the rack, as follows: **1.** Secure the duplexer to the rack using the four screws which were previously removed. **2.** Reconnect the Rx output, Tx input, antenna output, and ground cables from the duplexer.
6	Set the rocker switch on the front of the power supply to the ON (1) position.
7	Enable the channel as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The channel is enabled.

Replacing an Antenna Relay

To replace the antenna relay, perform Procedure 9-13.

WARNING

Shock hazard. The GTR 8000 Base Radio contains dangerous voltages which can cause electrical shock or damage to equipment. Set the power supply switches for the affected equipment to the Off (0) position when servicing this component in the base radio.

IMPORTANT

Powering down the base radio will cause any affiliated subscribers to relocate to another channel at the site or another channel at an adjacent site. It is recommended that you disable the channel before powering down, so that the system does not attribute the loss of channel to a failure. You can disable a channel using Unified Event Manager or the Configuration/Service Software (CSS).

Procedure 9-13 How to Replace an Antenna Relay

1	Wear an electrostatic discharge (ESD) wrist strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2	Disable the channel as follows: **1.** Connect to the device module's Ethernet service port using Configuration/Service Software (CSS). See “Connecting Through an Ethernet Port Link” in the Configuration chapter. **2.** Open CSS and select **Test & Measurement Screen** from the Service menu. **3.** Click **Change to Service Mode**. **Result:** The channel is disabled.
3	Set the rocker switch on the front of the power supply to the OFF (0) position.
4	Remove the antenna relay from the base radio, as follows: **1.** Mark all cables and remove. RX (NC) position, TX (NO) position, Antenna (C) connection position, and power connection position. **2.** Remove the two screws that are holding the antenna relay to the backplane cover using a T15 bit and remove the antenna relay.
5	Replace the antenna relay to the base radio, as follows: **1.** Attach the new antenna relay using the screws previously removed and torque to 15 in./lb. **2.** Attach all cables and tighten coax connectors.
6	Set the rocker switch on the front of the power supply to the ON (1) position.
7	Enable the channel as follows: **1.** Open CSS and select **Test & Measurement Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The channel is enabled.

Chapter

10

GTR 8000 Base Radio Reference

Reference information for GTR 8000 Base Radios and subsystems includes LED states and specifications for individual GTR 8000 Base Radio RFDS modules.

This chapter contains supplemental reference information relating to GTR 8000 Base Radio.

LEDs

Many of the LEDs on the GTR 8000 Base Radio devices provide an indication for one or more the following conditions:

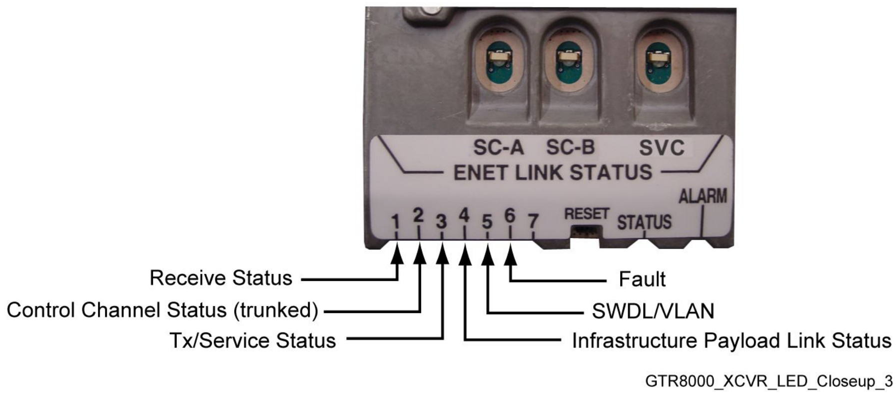
- **Lamp Test:** The Lamp Test state is used to verify that the indicators are operational. For Lamp Test, the LEDs stay in this state for only a second or less.
- **Failure:** Indicates a failure that can only be fixed through replacement. If something other than a hardware fault is causing the state, Impaired will be indicated.
- **Impaired:** The device is not fully operational due to internal or external causes. Some corrective action must be taken to get back to 100% operation.
- **Booting Up:** The device is not in service due to running of diagnostics or initializing.
- **Online:** Indicates that the device is fully operational.

The LEDs for the transceiver and power amplifier modules can be viewed through the door to the left of the fans, with the door opened or closed.

Transceiver LEDs

This section covers the LEDs for the transceiver (see Figure 10-1).

Figure 10-1 GTR 8000 Base Radio Transceiver LEDs (viewable through drop-down door)



The Status LED is green, and the Alarm LED is red. These LEDs (see Table 10-1) are either off or on, depending on the condition of the transceiver.

Table 10-1 Transceiver Status and Alarm LEDs

Condition	Green Status LED	Red Alarm LED
No Power	Off	Off
Lamp Test (During Reset)	On	On
Impaired Operation	On	Blinking
Critical Failure	Off	On
Booting Up	Blinking	Off
Operational	On	Off

Note: To get detailed information on current operation and fault status, use the CSS Status Panel screen.

The following LEDs (see Table 10-2) indicate Ethernet link connections between the transceiver, site controllers and the front panel service port.

Table 10-2 Transceiver Ethernet Link Status LEDs

LED Name	Indication	LED Status
ENET SC-A (external connection to SITE CTRL A on the rear of the chassis)	Ethernet link inactive (Remote PHY/MAC not detected.)	Off
	Ethernet link established (Remote PHY/MAC detected and auto-negotiation completed.)	Green
	Ethernet link active (Actively transmitting or receiving data.)	Amber (blinking)
ENET SC-B (external connection to SITE CTRL B on the rear of the chassis)	Ethernet link inactive (Remote PHY/MAC not detected.)	Off
	Ethernet link established (Remote PHY/MAC detected and auto-negotiation completed.)	Green
	Ethernet link active (Actively transmitting or receiving data.)	Amber (blinking)

Table 10-2 Transceiver Ethernet Link Status LEDs (Continued)

LED Name	Indication	LED Status
ENET SVC (front panel service port)	Ethernet link inactive (Remote PHY/MAC not detected.)	Off
	Ethernet link established (Remote PHY/MAC detected and auto-negotiation completed.)	Green
	Ethernet link active (Actively transmitting or receiving data.)	Amber (blinking)

The LEDs (see Table 10-3) can be green, red or amber depending on the condition.

Table 10-3 Application-Controlled Transceiver LEDs

Condition	LED 1 Receive Status	LED 2 Control Channel Status	LED 3 TX/Service status	LED 4 Infrastructure Payload Link Status
Booting Up*	Green	Green	Green	Green
Lamp Test	Amber	Amber	Amber	Amber
Receiver Inhibited	Amber (blinking)			
Receiver Active	Green			
RF Channel Interference	Red (blinking)			
Monitor Before Data Transmit	Green			
Illegal Carrier	Red (blinking)			
Control Channel (Operating)		Green		
Control Channel (Failsoft)		Green (blinking)		
Service Mode			Amber	
Transmitter Inhibited			Amber (blinking)	
Infrastructure Link Connected (V.24, IP, and 4–wire/V.24)				Green
Partial Infrastructure Link Established (V.24 link established, 4–wire link not established)				Amber
Infrastructure Link Disconnected (V.24, IP, and 4–wire/V.24)				Green (blinking)

Table 10-3 Application-Controlled Transceiver LEDs (Continued)

Condition	LED 1 Receive Status	LED 2 Control Channel Status	LED 3 TX/Service status	LED 4 Infrastructure Payload Link Status
* During a normal boot up sequence, LEDs 1 through 4 blink from left to right and from right to left continuously for several seconds.				

For the service-controlled LEDs (see Table 10-4) the color of all LEDs must be observed in order to interpret the condition of the transceiver.

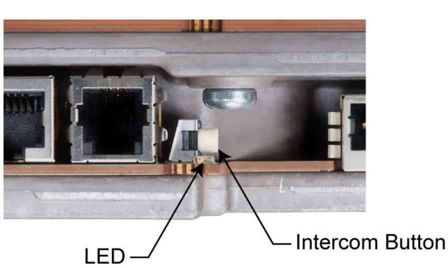
Table 10-4 Services-Controlled Transceiver LEDs

Condition	LED 5 SWDL/VLAN	LED 6 Fault	LED 7
Lamp Test	Amber	Amber	Amber
Receiver Inhibited		Red	
Receiver Reference Failure		Red	
Transmitter Inhibited		Red	
SWDL (Software Download transfer in progress)	Green		
Warning		Amber	
Minor Hardware Failure		Amber (blinking)	
Major Hardware Failure		Red (blinking)	
Critical Hardware Failure		Red	
VSWR Fault		Red	

Transceiver Option Card Intercom LED

The Transceiver Option Card has a single Intercom LED that indicates the intercom function between the ON (amber) and OFF states.

Figure 10-2 Transceiver Option Card Intercom LED (viewable behind the fan module)



XCVR_Option_Card_Intercom_LED

Power Amplifier LEDs

This section covers the LEDs for the power amplifier (see Figure 10-3).

Figure 10-3 Power Amplifier LEDs, viewable through drop-down door

GTR8000_PA_LED_Closeup

The color of all the power amplifier's LEDs (see Table 10-5) must be observed in order to interpret the power amplifier's condition. For example:

- If the Alarm LED is red and the Transmit and Status LEDs are not lit, the condition is "PA Failure" and the power amplifier module should be replaced.

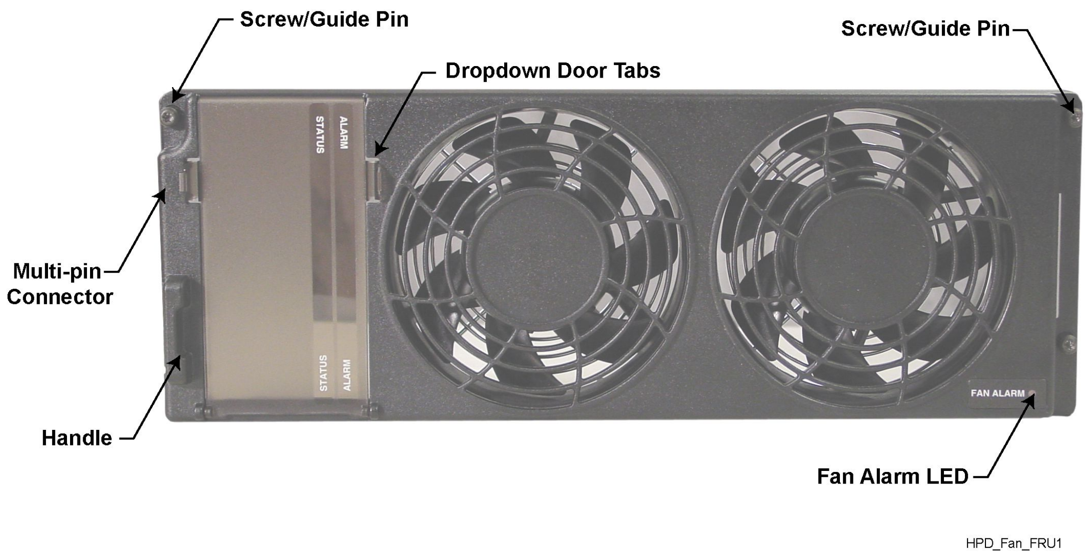
Table 10-5 Power Amplifier LEDs

Condition	Transmit (XMIT)	Status	Alarm
Power Off	Off	Off	Off
Lamp Test (lights for 1 second at power up)	Amber	Green	Red
Not Transmitting	Off	Green	Off
Transmitting at Full Requested Output Power	Green	Green	Off
Transmitting at Less Than Requested Power	Amber	Green	Red (blinking)
PA Failure	Red	Off	Red
Receive Only	Off	Off	Off
Transmitter Inhibited	Off	Green	Red (blinking)

Fan Module LED

This section covers the LEDs for the fan module (see Figure 10-4).

Figure 10-4 Fan Module-Alarm LED at lower right corner



The fan module has one “Fan Alarm” LED visible on the lower right corner of its front panel. The Alarm is red during Lamp Test (for a second or less), and remains red if there is a fan failure. A fan failure alarm occurs if the built in speed sensor detects that either fan drops 30% below rated speed. A red Fan Alarm indicates that the fan module needs to be replaced.

NOTE

The GTR 8000 Base Radio will operate at full capability for at least seven days after the fan alarm first occurs, allowing normal operation without requiring an immediate service call.

Power Supply LEDs

This section covers the LEDs for the power supply (see Figure 10-5).

Figure 10-5 Power Supply Module

HPD_Power_Supply_FRU.jpg

The power supply has three LEDs (see Table 10-6) visible from the front panel. The color of all the power supply's LEDs must be observed in order to interpret its condition. For example:

- If the Alarm and Fan LEDs are red and the Status LED is green, the condition is "Lamp Test"
- If the Alarm LED is red and the Fan and Status LEDs are not lit, the condition is "Power Supply Failure"

Table 10-6 Power Supply LEDs

Condition	Fan	Status	Alarm
Power Off	Off	Off	Off
Lamp Test	Red	Green	Red
Online	Off	Green	Off
Impaired	Off	Green	Red (blinking)
Power Supply Failure	Off	Off	Red
Power Supply Fan Failure	Red	Green	Off

RFDS Equipment Specifications

This section provides specifications for all the RFDS equipment.

IMPORTANT

Specifications are subject to change without notice.

Transmit Filter Specifications (700/800 MHz)

Table 10-7 provides the specifications for the transmit filter (700/800 MHz).

Table 10-7 Transmit Filter Specifications (700/800 MHz)

	Tx Filter Spec Limit (700/800 MHz)	800 MHz Typical	Notes
Frequency range	762-776 MHz, 851–870 MHz		
Insertion loss	0.7 dB	0.3 dB	
VSWR max.	1.5:1	1.12:1	
Rx selectivity	35 dB	40 dB	
Peak instantaneous power	32000 W		
Passive Intermodulation	–135 dBc		2 x 43 dBm
Input Connector	7/16		
Output Connector	7/16		
Power monitor connector	Dsub-9 Male		
Forward power range	0-500 W		0-5V DC out
Reverse power range	0-500 W		0-5V DC out

Preselector Filter Specifications (700/800 MHz)

Table 10-8 provides the specifications for the preselector filter (700/800 MHz).

Table 10-8 Preselector Filter Specifications (700/800 MHz)

	Preselector Spec Limit (700/800 MHz)	Typical
Frequency range	792-825 MHz	
Insertion loss	1 dB	0.7 dB
VSWR max.	1.5:1	1.3:1
Tx selectivity	15 dB	18 dB
Input Connector	QMA	
Output Connector	QMA	

Preselector Filter Specifications (UHF)

Table 10-9 provides the specifications for the preselector filter (UHF).

Table 10-9 Preselector Filter Specifications (UHF)

	Preselector Spec Limit (UHF)	Typical
Tuning range	380–433MHz, 435–470 MHz, 470–524 MHz	
Bandwidth	4 MHz	
Insertion loss	2 dB	1.3 dB
VSWR max.	1.9:1	1.5:1
Input Connector	Mini-UHF	
Output Connector	Mini-UHF	

Preselector Filter Specifications (VHF)

Table 10-10 provides the specifications for the preselector filter (VHF).

Table 10-10 Preselector Filter Specifications (VHF)

	Preselector Spec Limit (VHF)	Typical
Tuning range	136–154 MHz, 150–174 MHz	
Bandwidth	4 MHz	
Insertion loss	1.3 dB	1.1 dB
VSWR max.	1.9:1	
Input Connector	Mini-UHF	
Output Connector	Mini-UHF	

Duplexer Specifications (700/800 MHz)

Table 10-11 provides the specifications for the duplexer (700/800 MHz).

Table 10-11 Duplexer Specifications (700/800 MHz)

	Duplexer Spec Limit (700/800 MHz)	Typical	Notes
Tx Frequency range	762-776 MHz , 851-870 MHz		
Rx Frequency range	792-806 MHz, 806–825 MHz		
Insertion loss Tx	1 dB	0.5 dB	
Insertion loss Rx	1 dB	0.6 dB	
VSWR max.	1.5:1	1.23:1	
Rx isolation	80 dB	85 dB	
Tx isolation	80 dB	85 dB	
Passive Intermodulation	–120 dBc		2 x 43 dBm
Antenna Connector	QN		
Rx/Tx Output Connector	QN		

Duplexer Specifications (UHF)

Table 10-12 provides the specifications for the duplexer (UHF).

Table 10-12 Duplexer Specifications (UHF)

	Duplexer Spec Limit (UHF)	Typical	Notes
Frequency range	380–403 MHz, 403–435 MHz, 435–470 MHz, 470–494 MHz, 494–512 MHz		
Insertion loss Tx*	1.3 dB	1.1 dB	
Insertion loss Rx*	1.3 dB	1.1 dB	
VSWR max.	1.3:1	1.2:1	
Rx isolation* <470 MHz >470 MHz	 100 dB 100 dB		 R/T 5 MHz R/T 3 MHz
Tx isolation* <470 MHz >470 MHz	 100 dB 100 dB		 R/T 5 MHz R/T 3 MHz
Antenna Connector	N female		
Rx/Tx Output Connector	N Female		

* For <470 MHz R/T can be as low as 3 MHz and for >470 MHz R/T can be a low as 2 MHz; however, insertion loss or isolation specs may not be met.

Duplexer Specifications (VHF)

Table 10-13 provides the specifications for the duplexer (VHF).

Table 10-13 Duplexer Specifications (VHF)

	Duplexer Spec Limit (VHF)	Typical	Notes
Frequency range	136–146 MHz, 144–160 MHz, 158–174 MHz		
Insertion loss Tx*	1.3 dB	0.7 dB	
Insertion loss Rx*	1.3 dB	0.7 dB	
VSWR max.	1.5:1	1.2:1	

Table 10-13 Duplexer Specifications (VHF) (Continued)

	Duplexer Spec Limit (VHF)	Typical	Notes
Rx isolation*	75 dB	80 dB	
Tx isolation*	75 dB	77 dB	
Minimum Tx-Rx Frequency Spacing	1.5 MHz		
Antenna Connector	N female		
Rx/Tx Output Connector	N Female		

* Minimum Tx-Rx spacing may be as low as 1.0 MHz; however, insertion loess of isolation may not be met.

External Dual Circulator Specifications (700/800 MHz)

Table 10-14 provides the specifications for the external dual circulator (700/800 MHz).

Table 10-14 External Dual Circulator Specifications (700/800 MHz)

	External Dual Circulator Spec Limit (700/800 MHz)	Typical
Operating Frequency Range	762-870 MHz	
Insertion Loss	1.6 dB	1.2 dB
Input Return Loss	18 dB	
Reverse Isolation	40 dB	42 dB
Power (continuous)	200 W	
Harmonic Attenuation	60 dB	
Intermodulation (2 tone, 100 W each)	-75 dBc	
Input Connector	RF cable with N male	
Output Connector	N female	

External Dual Circulator Specifications (UHF)

Table 10-15 Table provides the specifications for the external dual circulator (UHF)

Table 10-15 External Dual Circulator Specifications (UHF)

	External Dual Circulator Spec Limit (UHF)	Typical
Operating Frequency Range	380–435 MHz, 435–470 MHz, 470–524 MHz	
Insertion Loss	1.6 dB	1.2 dB
Input Return Loss	18 dB	24 dB
Reverse Isolation	40 dB	50 dB
Power (continuous)	200 W	
Harmonic Attenuation <10 GHz)	55 dB	
Input Connector	RF cable with N male	
Output Connector	N female	

External Dual Circulator Specifications (VHF)

Table 10-16 provides the specifications for the external dual circulator (VHF).

Table 10-16 External Dual Circulator Specifications (VHF)

	External Dual Circulator Spec Limit (VHF)	Typical
Operating Frequency Range	136–146 MHz, 144–160 MHz, 158–174 MHz	
Insertion Loss	1.6 dB	0.7 dB
Input Return Loss	18 dB	25 dB
Reverse Isolation	40 dB	50 dB
Power (continuous)	200 W	
Harmonic Attenuation <10 GHz)	50 dB	
Input Connector	RF cable with N male	
Output Connector	N female	

Antenna Relay Specifications

Table 10-17 provides the specifications for the antenna relay.

Table 10-17 Antenna Relay Specifications

	Antenna Relay Spec Limit	Typical
Operating Frequency Range	DC to 4 GHz @ 20º C	
Maximum Input Power	300 W @ 1–4 GHz	
Coil Specifications: pull-in voltage drop-out voltage resistance	 21.0 V min. 2.0 V max. 430 Ω ±10% @ +20º C	
Contact Specifications: type actuation pull-in time drop-out time & remake NC contacts	 SPDT Failsafe (break before make) 20 ms max. @20º C 20 ms max. @20º C	
Insertion Loss	0.30 dB max.	
Isolation	70 dB min.	
VSWR Maximum	1.3 : 1	
Temperature Range	–30º C to +80º C	
Terminations	Female N-type	
Input and Output Impedance	50 Ohms	

Chapter

11

GTR 8000 Base Radio Disaster Recovery

This chapter provides references and information that will enable you to recover a GTR 8000 Base Radio in the event of failure.

Recovery Sequence for GTR 8000 Base Radio

Follow the steps in Process 11-1 to recover the GTR 8000 Base Radio.

Process 11-1 Recovering the GTR 8000 Base Radio

1	Replace the GTR 8000 Base Radio transceiver module. See Chapter 9, "How to Replace the Transceiver Module" in the *GTR 8000 Base Radio* manual.
2	Perform basic device configuration via the serial port. See Chapter 4, "How to Connect Through a Serial Port Link" in the *GTR 8000 Base Radio* manual.
	1. Set the IP address of the device. See Chapter 4, "How to Set a Devices IP Address in CSS" in the *GTR 8000 Base Radio* manual.
	2. Set the serial security services. See Chapter 4, "How to Set the Serial Security Services Using CSS" in the *GTR 8000 Base Radio* manual.
3	Perform basic device configuration via the Ethernet port. See Chapter 4, "How to Connect Through an Ethernet Port Link" in the *GTR 8000 Base Radio* manual.
	1. Set the current date and time in CSS. See Chapter 4, "How to Set the Date and Time Using CSS" in the *GTR 8000 Base Radio* manual.
	2. Set up the local Password Configuration using the CSS (optional). See Chapter 4, "How to Set the Local Password Configuration Using CSS" in the *GTR 8000 Base Radio* manual.

Process 11-1 Recovering the GTR 8000 Base Radio (Continued)

4 Complete the configuration of the Information Assurance features using CSS, as follows:

1. Change the SNMPv3 configuration and user credentials from CSS. See Chapter 4, “How to Change SNMPv3 Configuration and User Credentials Using CSS” in the *GTR 8000 Base Radio* manual.

2. Create, update, or delete an SNMPv3 user. See Chapter 4, “How to Add or Modify an SNMPv3 User Using CSS” in the *GTR 8000 Base Radio* manual.

3. Verify the SNMPv3 credentials. See Chapter 4, “How to Verify SNMPv3 Credentials Using CSS” in the *GTR 8000 Base Radio* manual.

4. Set the SWDL transfer mode. See Chapter 4, “How to Set the SWDL Transfer Mode Using CSS” in the *GTR 8000 Base Radio* manual.

5. Configure DNS using the CSS. See Chapter 7, “Configuring DNS Using CSS” in the *Authentication Services* manual.

6. Configure for SSH. See Chapter 4, “Configuring SSH for RF Site Devices and VPMs Using CSS” in the *Securing Protocols with SSH* manual or see “Device Security Configuration Remote Access/Login Banner (Ethernet)” in the *CSS Online Help*.

NOTE

Make sure to Restore the Clear Protocols parameters.

7. Enable RADIUS Authentication using the CSS. See Chapter 7, “Configuring RADIUS Sources and Parameters Using CSS” in the *Authentication Services* manual.

8. Enable Centralized Authentication using the CSS. See Chapter 7, “Enabling/Disabling Centralized Authentication Using CSS” in the *Authentication Services* manual.

9. Set the Local Cache Size for Centralized Authentication using the CSS. See Chapter 7, “Setting the Local Cache Size for Central Authentication Using CSS” in the *Authentication Services* manual.

10. Enable Centralized Event Logging using the CSS (optional). See Chapter 6, “How to Enable/Disable Centralized Event Logging on Devices Using CSS” and Chapter 1, “Event Logging Client Configuration” for proper hostnames in the *Centralized Event Logging* manual.

11. Set the NTP Server Settings. See “Chapter 4 “Setting the NTP Server Settings” in the *GTR 8000 Base Radio* manual.

5 Perform a site software download (SWDL) with the SNMPv3 package (if SNMPv3 is desired) of the device and associated site devices. Refer to one of the following procedures:

- **Trunked GTR 8000 Base Radios:**
    - For GTR 8000 Base Radios with PSC 9600 Site Controller: Procedure 11-1, "How to Download Software and Configuration Settings to a GTR 8000 Base Radio – PSC 9600 Site Controller," on page 11-3.
    - For GTR 8000 Base Radios with GCP 8000 Site Controller: Procedure 11-2, "How to Download Software and Configuration Settings to a GTR 8000 Base Radio – GCP 8000 Site Controller," on page 11-6.
- **Conventional GTR 8000 Base Radios:** Refer to “Downloading Software” in the *Software Download* manual. To perform the software download operation, follow the “Performing Operations on a Single Off-line Device” procedure.

Process 11-1 Recovering the GTR 8000 Base Radio (Continued)

	NOTE For a conventional base radio, software download should be done independently choosing SINGLE DEVICE mode.
6	On systems with MAC Port locking, disable the locking and then re-enable the locking with the MAC address of the base radio. The device being replaced may be connected to an Ethernet port on a switch which implements MAC Port locking (HP switch or site controller). If so, the Ethernet switch port will need to be unlocked and relocked to the MAC address of the replacement device. See the *Ethernet Port Security* volume for instructions on how to disable and enable MAC port locking. **NOTE** Following the device restoration, if it was connected to an HP switch port, the HP switch port may have been disabled due to an unexpected MAC address. If so, re-enable the port on the HP switch.
7	Replace the transceiver in the UNC. See Chapter 4, “Replacing a Device” in the *Unified Network Configurator* manual.
8	Discover the base radio in the UEM. See the *Unified Event Manager* manual.

NOTE

The following procedure does not apply to a site with a GCP 8000 Site Controller. To perform the download for a site with a GCP 8000 Site Controller, refer to Procedure 11-2, "How to Download Software and Configuration Settings to a GTR 8000 Base Radio – GCP 8000 Site Controller," on page 11-6.

Procedure 11-1 How to Download Software and Configuration Settings to a GTR 8000 Base Radio – PSC 9600 Site Controller

1	Transfer and install the latest software, using Software Download (SWDL) with SNMPv3 package (if SNMPv3 is desired) to the site controller and base radios, as follows: **1.** Connect an Ethernet straight through cable between the Ethernet port on the computer and the Ethernet LAN switch. The laptop IP address must be set to an address on the subnet of the local site, which varies depending on the site and zone numbers.
2	Open the CSS application.
3	Select **Connection Configuration** from the **Tools** menu, or click the **Connect to Device** button on the toolbar. **Result:** The Connection Screen appears.
4	Verify that **Ethernet** is selected in the **Connection Type** area.
5	Specify the IP address for the device in the Ethernet Settings area. Do the following:

IF you	THEN

Procedure 11-1 How to Download Software and Configuration Settings to a GTR 8000 Base Radio – PSC 9600 Site Controller (Continued)

Step		
	Know the IP address of the device.	**1.** Enter the IP address of the device in the **Device IP Address** field. **2.** Continue with step 6.
	Do not know the IP address of the device, but know the system identification of the device (the zone, site, and device ID of the device)	**1.** Click **Fetch DNS Entry**. **Result:** The DNS IP Address Calculation screen dialog box appears. **2.** Select the desired device type from the **Device** list box. **3.** Enter the proper values in the **Zone**, **Site**, and **Device ID** fields. **4.** Click **OK**. **Result:** The **DNS information** of the device automatically appears in the **Device IP Address** field. **5.** Continue with step 6.
6	To make the connection, click **Connect**.	
7	Select **Read Configuration From Device** from the **File** menu. You can also click the **Read Configuration to Device** button. **Result:** The parameters download from the device to the computer. When the download is complete, the CSS Main window opens. You can use the map on the left side of the screen to view configuration information for the device.	
8	Open the Software Download application. **CAUTION** **There is a possibility of a mismatch in software versions when replacing the transceiver module with an on-hand spare. If a mismatch in software versions occurs, this may cause the transceiver to go into a configuration mode of operation with a reason of 'Invalid Software Version'.**	
9	Download and install the necessary software onto the site controllers and base radio as follows: **1.** Select the Site Type: Repeater. **2.** Select the Zone and Site. **3.** Click **Connect**. **Result:** The system connects to the specified zone and site. **4.** Select **Transfer and Install** for the Operations Type. **5.** Select both **Repeater Site Controller** and **Site Repeater** for the Application Type. **6.** Select a Software Component from the drop-down list. **7.** If the desired Software Component needs to be imported:	

Procedure 11-1 How to Download Software and Configuration Settings to a GTR 8000 Base Radio – PSC 9600 Site Controller (Continued)

	◦ Go to **File**, **File Manager** then select **Component Operations/Import Fileset** and browse to the location of the fileset. ◦ Select the fileset, click **Generate** to create a new component for the imported fileset, then click **OK**. **8.** Click **Start Operation** button to download and install the software. NOTE The Software Download client software may display a warning that all device types must be upgraded at the same time and that Site Controller-only or Channel-only installs are prohibited. If that warning is displayed, ensure that you are performing a Site SWDL rather than a single device SWDL. **Result:** The site controllers and the base radios are all loaded with the new software.
10	Restore Codeplug Archive from backup. Reload the base radio configuration file on to the new base radio, as follows: **1.** From the CSS application File menu, select **Open**. Locate and open the previously saved configuration file for the base radio, and click **OK** on the Properties window. NOTE If you were not able to back up the base radio configuration from the previous base radio, you can use the configuration from your system build book or use the default base radio configuration file. Specific settings for the base radio must still be configured. See the *CSS Online Help* or Chapter 4 in the *GTR 8000 Base Radio* manual for detailed configuration instructions. **2.** From the File menu, select **Write Configuration To Device**, and then click **OK** on the confirmation message. **Result:** The configuration from the file you selected is loaded into the new base radio. Communication with the base radio is not available until the reset is complete.
11	Enable the base radio as follows: **1.** Open CSS and select **Mode Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The base radio is enabled.
12	Disconnect the laptop PC from the site controller.

Procedure 11-2 How to Download Software and Configuration Settings to a GTR 8000 Base Radio – GCP 8000 Site Controller

1 Connect an Ethernet straight through cable between the Ethernet port on the computer and the Ethernet service port on the site controller. The laptop IP address must be set to an address on the subnet of the local site, which varies depending on the site and zone numbers. See Chapter 4, “How to Connect Through an Ethernet Port Link” in the *GCP 8000 Site Controller* manual.

NOTE

If 802.1x services are enabled on the site controller, an 802.1x login account to connect to the Ethernet port is needed. An 802.1x account is a centrally managed account. See Chapter 6, “802.1x Service Port Procedures for GCP 8000 Site Controller” in the *802.1x Service Ports on Switches* manual.

2 Open the Software Download application.

CAUTION

There is a possibility of a mismatch in software versions when replacing the transceiver module with an on-hand spare. If a mismatch in software versions occurs, this may cause the transceiver to go into a configuration mode of operation with a reason of ‘Invalid Software Version’.

3 Download and install the necessary software onto the site controllers and base radio as follows:

1. Select the Site Type: Repeater, HPD, or Simulcast.

2. Select the Zone, Site, and if applicable, the Subsite. The Subsite ID is only available when the Site ID is between 1-64.

3. Click **Connect**.

Result: The system connects to the specified zone and site.

4. Select **Transfer and Install** for the Operations Type.

5. Select the Application Type:

- For an HPD site: select both **HPD Site Controller** and **HPD Base Radio**.
- For a Repeater site: select both **Repeater Site Controller** and **Site Repeater**.
- For a Simulcast site: select **Multisite Base Radio**.
- For a Simulcast site with a GPB 8000 Reference Distribution Module: select **Multisite Base Radio**, and **GPB 8000 Reference Distribution Module**

6. Select a Software Component from the drop-down list.

NOTE

Both the site controller and base radio software must be chosen as part of the Site Software Download.

7. If the desired Software Component needs to be imported:

Procedure 11-2 How to Download Software and Configuration Settings to a GTR 8000 Base Radio – GCP 8000 Site Controller (Continued)

	◦ Go to **File**, **File Manager**, then select **Component Operations/Import Fileset** and browse to the location of the fileset. ◦ Select the fileset, click **Generate** to create a new component for the imported fileset, then click **OK**. **8.** Click **Start Operation** button to download and install the software. **Result:** The site devices are all loaded with the new software.
4	Open the CSS application.
5	Restore Codeplug Archive from backup. Reload the base radio configuration file on to the new base radio , as follows: **1.** From the File menu, select **Open**. Locate and open the previously saved configuration file for the base radio. **NOTE** If you were not able to back up the base radio configuration from the previous base radio, you can use the configuration from your system build book or use the default base radio configuration file. Specific settings for the base radio must still be configured. See the *CSS Online Help* or Chapter 4 of the *GTR 8000 Base Radio* manual for detailed configuration instructions. **2.** Click **OK** on the Properties window. **3.** From the File menu, select **Write Configuration To Device**, then click **OK** on the confirmation message. **Result:** The configuration from the file you selected is loaded into the new base radio. Communication with the base radio is not available until the reset is complete.
6	Enable the base radio as follows: **1.** Open CSS and select **Mode Screen** from the Service menu. **2.** Click **Change to Normal Mode**. **Result:** The base radio is enabled.
7	Disconnect the laptop PC from the LAN switch.